MODERN Machine Shop

HOWARD CAMPBELL, Editor

olume 11 APRIL, 1939 Number 11

ublished monthly by
ner Publications, Inc.
431 Main St.,
Cincinnati, Ohio

ON G. GARDNER
President and
General Manager

OHN. M. KRINGS
dvertising Manager

. M. FILLMORE
248 Madison Ave.,
New York
Murray Hill 6-3899

EORGE H. MEYERS
ribune Tower, Chicago
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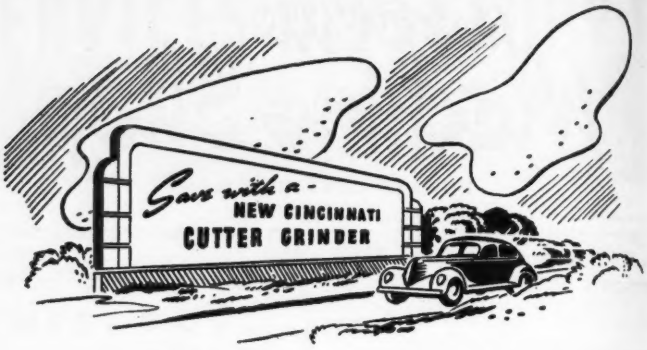
Circulation This Issue More Than 29,000



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MODERN Machine Shop

CINCINNATI, OHIO

APRIL, 1939 VOL. 11, NO. 11

Practical Heat Treating

The first article of a series in which the more important factors in modern heat treatment will be discussed. This article deals with Carburizing.

By FREDERICK TAYLOR POTTER

DURING the past few years a great deal has been written on the subject of heat treatment, much of it highly technical and the balance so insufficiently detailed as to be of little assistance to the practical man in making or operating an installation of heat treating equipment. It will therefore be the aim of this and succeeding articles to fill the gap and to provide certain non-technical details intended to be of use and interest. The suggestions that will be offered are drawn from practical experience and have been proved in actual use.

The wearing qualities of most steel parts can be increased to the desired degree by the formation of a hard surface over a softer and tougher core, thus producing, practically, the wear resistance of hardened carbon tool steel without its brittleness and higher cost.

For many such parts, cold drawn Bessemer screw stock or hot rolled machinery steel are commonly used. These steels are satisfactory for use in many screw machine parts and others where uniform hardness are not vital, but for the more exacting steady production work where a high quality of case and hardness are necessary, a steel such as S.A.E. X1315, which is especially designed for case hardening, should be used. Such steels are strictly normal, will develop excellent, hard cases without soft spots, will machine well, and are only slightly more expensive than screw stock or machinery steel. They are well worth the difference.

For parts that need greater

strength, steels containing alloying elements that develop strength are used. Among these steels are several similar to S.A.E. 3115 or 4615 which are heat treated in much the same way as those already mentioned. Their use is recommended for shafts and like parts that are subject to heavy loads or repeated stresses in different directions.

There are so many kinds of steels used for carburizing, and such a variety of treatments, that only typical examples will be given here. Detailed information as to the temperatures for specialized steels may be easily obtained from their manufacturers or from readily - available charts. In general, plain low carbon steels like S.A.E. 1020, X1315 or X112 should be carburized at 1,600-1,650 deg. F. for a time sufficient to produce the desired case depth. The low carbon alloy steels should be heated to a point about 50 deg. F. lower. For light cases of about 0.015 in., 1,525-1,550 deg. F. is better because the carburizing rate is slower and, therefore, is easier to stop at the desired point. Quenching direct from the container at 100 deg. F. lower than the carburizing temperature will produce satisfactory hardness but rather large size grain, which results in some loss of strength. However, such loss of strength may not be detrimental in certain parts not subject to much stress.

A very common method of treatment is to carburize as described above, remove the pots from the furnace, and allow them to cool on the floor. The parts are then reheated to 1,480-1,500 deg. F. in lead, salt or oven furnace about one hour for each inch of cross section. Quench in water for S.A.E. 1020 or X1112, in oil for X1315 and the alloy steels. Use oil for parts of the first two steels if they are particularly subject to distortion.

Frederick Taylor Potter

After graduating from Harvard University, in 1924, Mr. Potter spent nine years in the machine tool business. During this time he obtained patents on multi-speed reduction gears and gas combustion devices. Since 1933 he has been connected with the textile industry, the past four years as assistant superintendent of Whitin Machine Works. In this position he has had supervision of heat treating, forging, and a number of machine departments.

For the best condition of case and core, the regenerative treatment is used. This method consists of carburizing at about 1,700 deg. F., cooling in the pot, reheating to 1,600 deg. F. for the plain carbon steels or 1,525-1,550 deg. F. for the alloys and quenching in oil. This treatment refines the core structure for maximum strength. Parts are then reheated to 1,450 deg. F. and quenched, in water or brine for S.A.E. 1020 or X112, and in oil for X1315. The alloys should be heated to about 1,4 deg. F. and quenched in oil. This second heating refines the case structure without affecting the core, due to its higher critical point.

Tempering of carburized work to relieve strain or increase toughness should be done at about 300-325 deg. F. for the former and up to 400 deg. F. for the latter. Higher temperatures will materially decrease the hardness.

Cooling in the pot and then giving the work a single reheat as in the first method mentioned above is necessary where parts are to be hardened other than all over. The heating can be done in lead or

so as to harden one or both ends of the piece or with other variations. Selective carburizing, or the casing of certain sections only, may be performed fairly satisfactorily by copper plating or coating with special refractory paints the sections where carburizing is not desired. In subsequent hardening of the piece as a whole, these coated sections will not be affected if they have been properly treated.

Carburizing can be accomplished by several different methods: by packing the work in carbonaceous material in sealed containers which are then heated in an oven type furnace; by revolving the work in the retort of a rotary furnace, using carbonaceous material or gas as carburizers; by packing in baskets or fixtures in the retort of a vertical furnace using gas or cracked oil as a carburizer or by running through a conveyor furnace using gas as the carburizer. Bath casehardening will be taken up later.

The containers used in the pack method should be designed with the size of work and ease of handling as well as pot-shape and material in mind. If each pot is to contain one workpiece, it should be of such size as to allow 1½ in. of packing material to be put in all around it. Since all of the materials shrink on heating, particularly the first time, the pot should be at least twenty per cent deeper than would otherwise be necessary. If miscellaneous small parts are to be packed, the size of the boxes is not important except from the standpoints of handling and long life, for both of which it is of advantage to have the boxes small. Another advantage of small boxes is that the work will be more uniformly heated, which is important where accurate-controlled case depths are required.

Most of the alloy casting manufacturers have standard size boxes, the designs of which have been tested in use. It is suggested that a box 12 x 8 x 12 in. deep with a close fitting cover of the small alloy material is practical equipment for small parts. The general shape of such a box is shown in Fig. 1. A long-handled fork supported by two small wheels will be found useful for handling these and other pots in and out of the furnace. In this size a box of the proper alloy may be expected to have 3,500 to 5,000 heat-hours of life. At this rate the alloy will be found more economical than cast iron

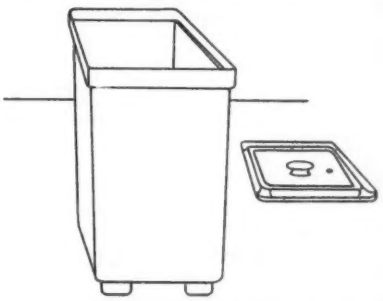


Fig. 1—Carburizing Pot.

or welded carbon steel in which the original investment is much lower. Pots of carbon steel or cast iron will give satisfactory service up to about 250 hours and will cost perhaps 12 cents per pound finished as against 90 cents per pound for a welded alloy steel or cast alloy iron box. As they near their breakdown point, pots of the unalloyed materials will lose their shape, covers will fit poorly, and air will leak in, causing faulty carburizing. In addition, pots of these plain materials have much less strength at elevated temperatures than the alloys and must be considerably heavier in order to endure for a satisfactory term of service. Therefore, more time and fuel are required to heat them. In selecting alloy steel for this service, one with 24 per cent chromium and 11 per

cent nickel will give good results, while in alloy iron one with 38 per cent chromium and 18 per cent nickel can be recommended.

Usually, boxes of cylindrical shape have the longest life. Tubes up to three or four feet in length, clamped together in groups so that they can be handled as a unit, will give good results on shafts. Such a container, with tubes of steel pipe or cast iron and clamped in a cast iron frame as illustrated in Fig. 3, is not expensive to make. Another inexpensive pot

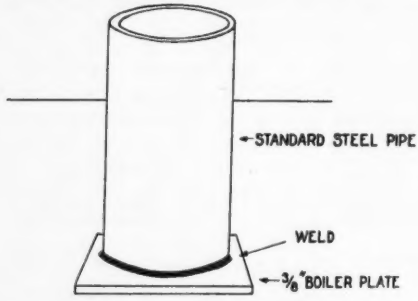


Fig. 2—Carburizing Pot made from steel pipe welded to a base of boiler plate.

may be made by welding the required length of six or eight-inch steel pipe to a square base of boiler plate cut slightly larger. This pot can readily be handled in the vertical position. To insure low leakage of the carburizing gas, all boxes should be so arranged that they may be luted or sealed after packing with fireclay or tight covers.

Carburizing compound has now largely taken the place of bone chips and other materials formerly used for the purpose. It has several advantages; greater uniformity of carburizing ability, very rapid action, and lower cost. It costs less to use because it is much lighter than bone and is "bought by weight while used by volume." It does, however, shrink somewhat more during its first use. Allowance must be made for th when packing the work. Anothe economy is the fact that it may b entirely used up, the only part to b discarded being the dust at the bo tom of the pile. By allowing the pi to stand in a dry place for a wee or so before being used again, it wi regenerate itself and may be use repeatedly.

Some compounds contain chemic energizers which tend to corrode a loy pots, the corrosion taking th form of a green deposit around th top. Should it appear, the use that carburizer should be discontin ued, since it will eventually destro the pots. In storing any compoun it is essential that it be kept in dry place, otherwise it will quickl pick up moisture, resulting possibl in soft spots in finished work.

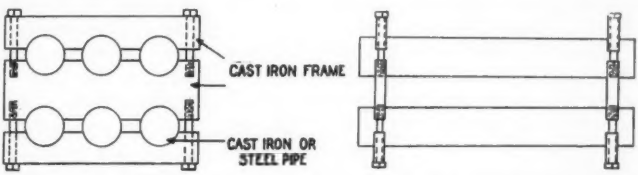
Where parts requiring cases o varying depths are carburized in th same furnace load, some method time control is necessary. A simpl way is to insert a short length of or $\frac{5}{16}$ in. cold drawn rod through small hole in the pot cover, allowin several inches to protrude. At th end of the estimated time it may b pulled out and quenched in wate Comparison of the case with thi specified will indicate whether the p load should be quenched at once allowed to remain longer in the hea

In addition to automatic temper ture control, a simple electric tim clock of the type that costs abo $30.00 will be found useful on elec tric furnaces, permitting occasiona jobs to be done during the nigh which would otherwise have to wa until the following day. This is particularly valuable feature for tem pering furnaces.

Practically any type of oven fu nace will give good results on th operation, the size of the furnace de pending on the size and amount work. Oil-firing is usually the lea

expensive, except where gas may be had at a very low rate. Since furnace atmosphere for this class of work is not important, it requires no special mention. Automatic temperature control is very desirable and should be installed if any amount of this work is to be done.

Rotary carburizing furnaces may be heated by gas, oil or electricity and are very economical for use on such parts as will not be damaged by the tumbling action of the retort or the distortion due to mass quenching. The high carbon case may be produced by the action of bone, compound or a suitable gas. With any one of the three the action is very rapid due to quick, uniform heating and the elimination of heating excess dead weight.



F.g. 3—Cylindrical Carburizing Pots clamped in a cast iron frame.

For most work, some sort of cushion is desirable to prevent marking in the retort. Such a cushion is provided by the use of compound or bone and at the same time accomplishes the carburizing at a rate which can be bettered but little by the introduction of gas as well. A load of four hundred pounds of small screws or nuts can be given a 1/64-in. case in about 1½ hours after the furnace reaches 1,400 deg. F. as it rises to its setting of 1,650 deg. F. In fact, the action is so rapid that it may be difficult to stop at the correct point on light case work.

Since it is difficult to take test samples from a furnace of this type, it is desirable to equip the furnace with a recording controller so that accurate timing is possible. The charts may be kept as records to provide information for the future. The alloy retort of such a unit is expensive, so a non-indicating, non-recording controller with a thermocouple in the combustion chamber is needed for regulating the maximum temperature outside the retort to prevent disastrous overheating.

A rotary is a most productive unit, handling two or even three capacity light case loads per eight-hour shift. To quench this amount of steel requires adequate facilities. For a furnace rated at 700-pound capacity per charge, oil and water tanks at least three feet square and three feet deep are needed. These should be of ¼-in. boiler plate with welded seams and should be sunk flush in the floor with their nearest edges about four feet from the furnace to provide the proper angle for the chute. They should be set side by side and fitted with steel covers of light non-slip floor plate reinforced with angle iron, hinged at their outside edges. An even better way is to make two pieces of each cover and hinge at both sides. They may then be used separately and can be walked upon when they are closed.

With oil quenching, the whole area is likely to become slippery, so non-slip steel is a good safety measure. Both tanks should be fitted with heavy mesh baskets or containers of perforated metal which can be lifted out by means of chain falls or hoists suspended from overhead rails or from an I-beam boom. This arrangement allows one hoist to serve both tanks and also handle the furnace

door, which is heavy and awkward to manipulate when hot. If this door is fitted with a three-foot rod in the middle of its outside end or has a projection on which a three-foot length of pipe can be applied when it is being opened or closed, one man can manage it.

The water tank should be supplied with a good flow of water from at least a two-inch pipe in the center of the bottom and should have a four-inch overflow. This will give excellent agitation while quenching. Do not use compressed air for agitation in any quench tank.

The oil tank should have similar intake and overflow connections. An effective and simple cooling system which will handle 400 to 500 lbs. per hour can be made by connecting the overflow (protected by a wire screen) to a twin strainer, from the strainer to a larger cooler in which the oil flows through tubes surrounded by a water jacket, and thence to a pump and back to the tank.

If the pump is within 10 feet of the overflow level, a motor-driven centrifugal of 25-30 g.p.m. will give sufficient cooling. A higher lift will probably require a gear pump to give satisfaction. For the water circulation in the oil cooler, the city service will be adequate or if a source such as a pond is used, a centrifugal pump slightly smaller than the size indicated will work well with a lift of not much over 10 feet.

A light but strong chute which can easily be directed to one tank or the other is necessary. If varying sizes of work are handled, it will be found convenient to have the frame built to receive interchangeable screens of several different meshes. The larger the mesh of the screen, the less compound will get into the tanks. The mesh should run as near as possible to the edges of the frame so that long, slender parts like pins will not collect at the sides and miss the quench.

The chute will need a collar at its top which will extend about half way around the mouth of the retort when in dumping position. Since the retort is usually revolved while being dumped, the parts and compound will travel part way up with it before falling out and will miss the chute if they are not guided into it. A chute 18 in. wide will be adequate for most work. The only other tools needed are two light, strong hoes with steel handles 6 ft. long with which to assist the dumping and to control the flow of work down the chute. Fig. 4 shows the arrangement of such an installation.

The possibilities of a rotary furnace are great, and warrant consideration for many kinds of production work. The use of the rotary furnace is limited only by the size of the work and the condition of its outside surfaces. Pieces up to two pounds in weight may be handled without serious marking if they are to be ground all over afterwards, while those with delicate surfaces, such as threads, can safely be done if they do not weigh over half a pound each.

Long, slender shafts are likely to distort badly if they are quenched in a mass and so must be handled individually in that operation. In any case, a protective cushion of carburizing material is advisable in the proportion of 40 to 50 lbs. to each 500-lb. charge.

Vertical carburizing furnaces sunk in pits in the floor are very convenient for certain kinds of work; particularly, small pieces which may be packed in baskets or fixtures and handled by means of hoists. It has an advantage over the rotary method in that the work is not marked except, possibly, in the quench. Furnaces may be heated by oil, gas or electricity and the carburizing pot

formed by a gas such as propane, mixed with air or by cracked oil of special composition.

Uniformity of case-depth is secured by using a sealed cover which allows a pressure to be built up within the retort, or by means of a circulating fan. Excellent results may be obtained by a combination of the two, together with a high rate of carburization. In designing work-holding fixtures, alloy steel of the 24-11 type mentioned before should be used, bearing in mind the necessity for free circulation of the gas and for a convenient way of dumping the fixtures or quenching them along with the work. Quench tanks and a cooling system such as described above will be satisfactory.

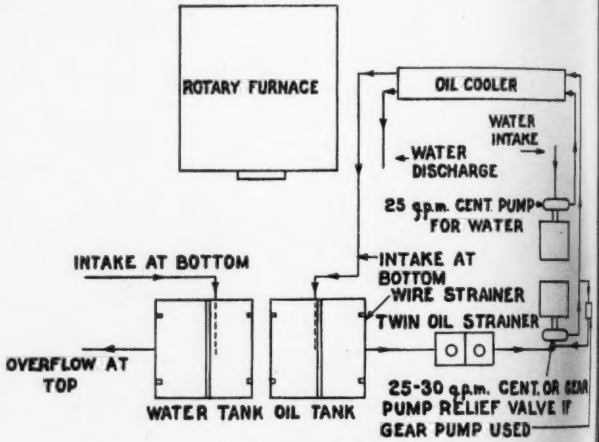


Fig. 4—Layout for Rotary Carburizing Furnace and Accessory Equipment.

The usefulness of vertical furnaces is limited by the necessity for perfect gas circulation and the difficulty of handling heavy loads in the quench.

Continuous carburizing requires highly specialized equipment, and since its use is limited to the high production of parts requiring practically the same case and depends for its economy on the handling of tremendous quantities of work, a brief description will suffice.

Such units may be of the belt conveyor type in which the work is carried on an endless alloy belt, or of the pusher variety in which the work is placed on trays and is advanced through the furnace by a mechanical or hydraulic pushing device. The pusher is the better adapted to heavy work which would raise the loading of an alloy belt beyond the safe point.

With such furnaces the work may be quenched, washed and tempered, if desired, making the entire operation automatic and requiring a minimum of labor. They may be electrically heated or fired by gas or oil, the first two being the common ways. The work is usually carried through an alloy muffle with a "valve" at each end to exclude air or else the combustion is made to take place within radiant tubes, the ends of the furnace being equipped with "valves." Electric equipment requires no muffle but needs means for control of the air at the ends of the work-passage.

Carburizing action is secured by the introduction of a mixture of a hydrocarbon gas like propane with air in definite proportions. It is necessary that this be accurately controlled as to proportion and uniformly applied to the various sections of the furnace if satisfactory results are to be had.

Limitations of this method are its very high first cost, the necessity for having a large production of similar parts and inflexibility compared to batch-type equipment. Continuous furnaces are at their best under steady operating conditions with large volume such as found in automotive work.

The above are the usual ways in which some of the light case and practically all of the 1/32 in. or deeper case work is done. The increasingly popular bath carburizing for medium depth cases and the widely used cyanide and activated baths for light cases, as well as the subject of nitriding, will be discussed in another paper.

Physics of Metal Cutting. By Hans Ernst. Published and distributed by The Cincinnati Milling Machine Company, Cincinnati, Ohio.

This 34-page booklet comprises a reprint of a lecture presented by Hans Ernst at the National Metal Congress held under the auspices of the American Society for Metals at Detroit, October 17-21, 1938. The author is Director of Research, Cincinnati Milling Machine and Cincinnati Grinders, Inc. In his lecture, Mr. Ernst begins with the older theories and conceptions of metal cutting tool action and leads into a discussion of his laboratory findings. He explains the behavior of metal in flowing under a flat-faced punch, and then shows, by means of moving pictures, how the metal flows under the pressure of a cutting tool. The motion pictures, taken through a microscope, show the formation of the chip on the cutting point, the compression of the chip, and the escape of the chip as the pressure is continued.

The book presents illustrations of the motion picture camera set up to take pictures of the chip flow under the microscope, sections from the moving picture film, photomicrographs showing cross sections of the chip and workpiece, microscopic views taken from the film showing the actual formation of the chip, and behavior of the metal in action. Here, probably for the first time, are presented photographs and descriptions of what actually takes place at the point of the cutting tool.

Copy free to any mechanical executive.

"Cutting Fluids," a 16-page illustrated booklet published by the Tide Water Associated Oil Company, is a comprehensive presentation of cutting fluids and their applications, from light automatic screw machine work to heavy broaching. Various types of cutting operations are classified and the functions of the cutting fluids involved are given in detail.

The booklet explains the need for a cutting fluid correct for the metal being cut and the machining operation involved if optimum results are to be secured. Schematic drawings illustrate the correct and incorrect methods of applying oil to the cutting operation.

In the discussion on Tycol transparent, non-tarnishing sulphurized cutting oils, recommended operations for the application of each oil are outlined. Also discussed in this section are other cutting oils, such as soluble oils, mineral oils and fatty oils, said to satisfy practically every condition encountered in the machining of all classes of metals.

The concluding section of the booklet is devoted to chemical composition tables of various alloy steels, as well as an explanation of the S.A.E. steel numbering system. Copies of this booklet may be obtained by writing to the Tide Water Associated Oil Company, 17 Battery Place, New York, N. Y.

"Bay State" Grinding Wheels. A complete catalog and price list covering the line of grinding wheels made by Bay State Abrasive Products Company, Westboro, Mass., is available from this company. Wheels listed include vitrified and silicate bonded, shellac bonded, rubber bonded, and resinoid bonded. A section is given over to other Bay State products — coping wheels, rubbing bricks, cylinder honing sticks, jointer stones, railway track bricks, and roll scouring bricks.

Tungsten Carbide Work Support Blades for use on Cincinnati Nos. 2, 1 and 4 Centerless Grinding Machines are featured in a four-page folder issued by Cincinnati Grinders Inc., Cincinnati, Ohio. These blades are generally suitable for the centerless grinding of most materials ⅛-in. diameter and larger. Copy free upon request.

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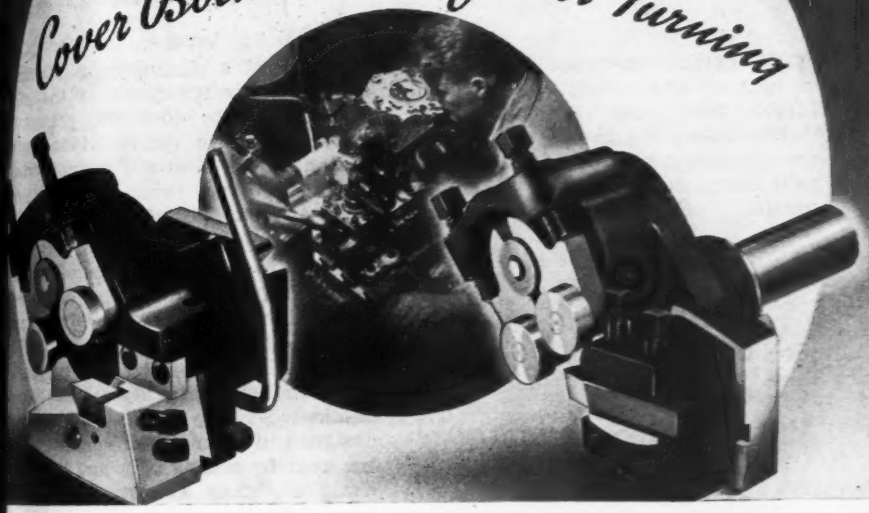
Cover Both Fields of Bar Turning



This new Warner & Swasey Single Cutter Turner is a high-production tool designed to handle the maximum feeds and speeds of modern turret lathes—ideal for high-speed steel or carbide cutters.

This tool is equipped with anti-friction bearing rollers—adjustable cutter block—shim for the cutter block—and flanged mounting to assure utmost rigidity.

The last word in a single cutter turner. You can get all details on this tool on page 72 of the new Warner & Swasey Tool Catalog.

• There are distinctly two separate fields of work for bar turners—one demands the utmost in accuracy at high speeds with heavy feeds, using high-speed steel or cemented carbide cutters—the other demand is for secondary work on new machines or for use on old turret lathes where maximum power and speed are not required. Here are the turners that meet both these demands.

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LET'S TURN IT FASTER, MORE ACCURATELY FOR LESS . . . WITH WARNER & SWASEY TOOLS

An Analysis of Ge

By DOUGLAS T. Ha

THE devices described in the first half of this article (published in March, 1939, issue of MODERN MACHINE SHOP) are intended primarily for checking individual elements of gear teeth, independent of other elements. Such devices are especially useful for checking original designs or when, at any given stage in the manufacture of the gear, a check on the individual elements is desired.

A close study of the action of gear teeth will reveal that there is always more than one tooth affecting the operation of a mating pair of gear so that a careful check of the individual elements does not present a complete picture. An individual tooth element check does not indicate what effect a certain error in one tooth will have on another tooth.

An inspection of all errors in combination more nearly meets the demands of manufacturing requirements because it more closely approaches the actual conditions which prevail when the gears are in operation. These conditions are practically duplicated in an inspection machine designed to record the inaccuracies of the gear by means of a red line on a chart and thus known as the "Red Liner." The operation of the machine, which is illustrated in Fig. 20, is based on the principle that errors in gears affect their center distance relation when the gears are brought into intimate contact and rotated. One gear (generally a master of known accuracy) is held on the driving spindle, the latter being retained in a fulcrumed bracket as shown in Fig. 21. The gear to be tested is held on a fixed stud, or fixture, depending upon its design.

Errors in the gear being tested impart a movement to the fulcrumed bracket which, in turn, through a multiplying lever arrangement, operates a pen which is in contact with

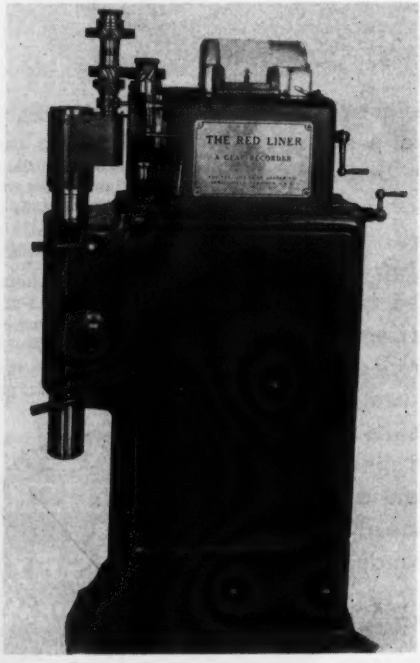


Fig. 20—Red Liner Recording Gear Inspection Machine.

Gear Inspection Methods

Fellows Gear Shaper Company, Springfield, Vt.

a constantly moving paper chart. This device charts all errors in combination and makes a permanent record. It is possible to analyze the charts so produced and to determine the magnitude and location of various inaccuracies. The multiplication is 200 to 1, so that an error of 0.001 in. in the gear is represented as 0.200 in. on the chart.

Analyzing Gear Tooth Inaccuracies from Red Liner Charts

The inspection machine unfailingly reproduces the inaccuracies in the work, and when the gear to be inspected is checked against a master of known accuracy, the result is a composite of all of the errors in the inspected gear. The errors, however, as the following charts will show, can be analyzed and their location and magnitude determined. These charts were made of the same spur gears which were projected in slides Nos. 1 to 8 inclusive.

Lack of Continuous Action

If the teeth of both gears are not of sufficient length, or have other defects which prevent continuous action, then the gears will fail to transmit uniform motion. Fig. 22 shows a chart of a gear, the teeth of which have been shortened to such an extent that continuous action is not obtained. Note the peculiar characteristics of the line. Action is interrupted as each tooth passes through mesh, causing a jagged peak and then a constant "building up" until action again ceases.

Uneven Tooth Spacing

Generally so-called errors in circular pitch produce a characteristic chart Fig. 23. This 32-tooth gear was cut with a cutter, each alternate tooth of which was purposely ground off from its true spacing position, resulting in the line shown. The complete chart shows sixteen jagged peaks, equal to one-half the number of teeth in the gear.

Variations in Pressure Angle

Fig. 24 shows a chart of a gear which varies in pressure angle from the master against which it was compared. Only a section of the chart is shown, but the complete chart shows 32 jagged peaks, equal

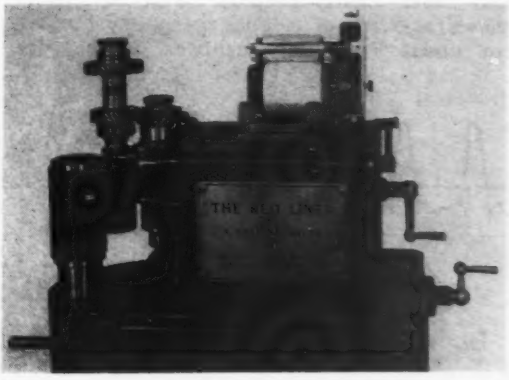
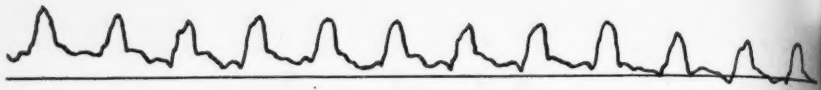


Fig. 21—The Master Gear is held on the driving spindle and the gear to be tested is held on a fixed stud.



LACK OF CONTINUOUS ACTION

Fig. 22—Chart of a gear with shortened teeth.

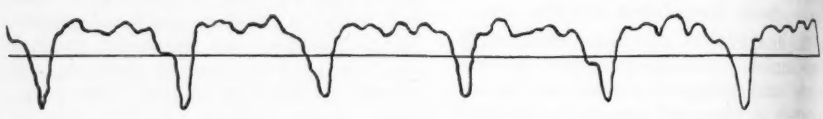
to the number of teeth in the gear. This error was purposely exaggerated, making the "peaks" higher and sharper than would normally be the case with slight errors in pressure angle. Slight errors in pressure angle produce a chart somewhat similar to a sine curve, as shown in Fig. 25. **A** and **B** on this chart indicate the points when the tooth of the master gear and the gear being tested, respectively, are centered on the line of centers.

Eccentricity

Lack of concentricity of the pitch circle is a common error, which the Red Liner clearly records. Fig. 26 shows a chart of a gear purposely cut about 0.004 in. eccentric. The eccentricity causes the recorded line to depart from the datum line in one revolution of the gear being inspected, reaching the maximum deviation when half way around the gear.

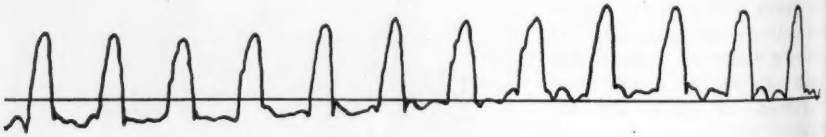
Interference

There is no difficulty in locating fillet interference, as it causes a series of abrupt departures from a straight line as shown in Fig. 27. In this case the cut gear was purposely made too shallow so that contact took place in the fillet before the profiles could come into intimate contact, causing the gears to alternately come together and then spread apart.



VARIATIONS IN CIRCULAR PITCH

Fig. 23—This chart indicates errors in the circular pitch of the gear.



VARIATIONS IN PRESSURE ANGLE

Fig. 24—This chart was made from a gear that varied in pressure angle from the master against which it was compared.

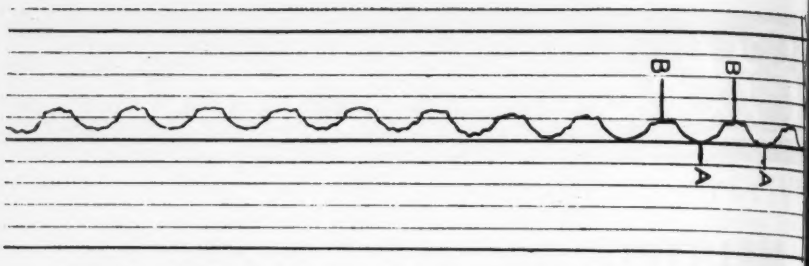


Fig. 25—Slight errors in pressure angle produce a graph similar to a sine curve.

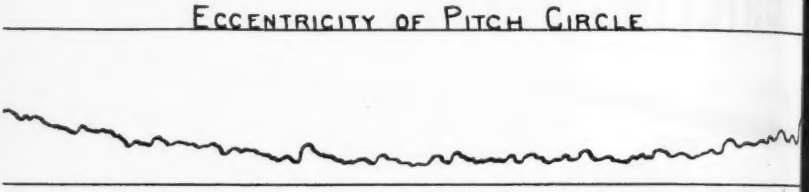


Fig. 26—This chart indicates an eccentric pitch circle.

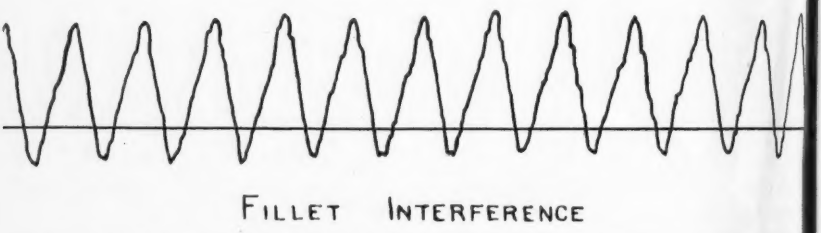


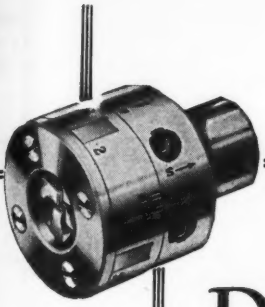
Fig. 27—Fillet interference is indicated on this chart. The gear was cut shallow, so that contact took place in the fillet first.

Charts of Cut, Hardened and Lapped Gears

In addition to recording tooth errors, the machine also presents an accurate picture of the contacting tooth surfaces. Fig. 28 shows a chart of a gear cut on the Gear Shaper without any particular pains being taken to obtain extreme accuracy—in fact, this would represent an average gear for this particular diameter and pitch. The accumulative errors do not exceed 0.001 in. The tooth surfaces are not extremely smooth and there are slight errors in circular pitch. This, however, would prove to be a satisfactory gear if it could be used without being heat treated after cutting.

While great strides have been made in producing steels for making gears, it is still impossible to put a gear in the fire and have it come out in the same condition that it went in. Distortion, although in some cases slight, still takes place and, as shown in Fig. 29, this particular gear did not improve any when placed in the fire.

Almost invariably gears swell dur-



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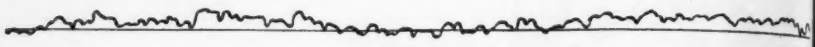
ing hardening. The two points on the teeth at which the greatest distortion takes place are in the fillet and at gear-type lap, it was possible to bring the gear back to its original accuracy as shown in Fig. 30. Not

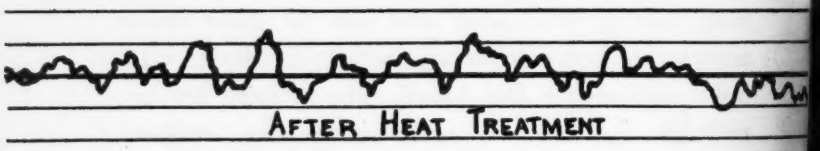


AFTER FINISH CUTTING

Fig. 28—Chart of an average spur gear for this particular diameter and pitch. The accumulative error does not exceed 0.001 in.

the top of the tooth. The fillet usually rises and the top of the tooth thickens on the end, which on the Red Liner is indicated as a combined interference and pressure angle variation error.

Before this particular gear was put only has the accuracy of the gear been improved, but the tooth surfaces are considerably smoother, assuring this lapped gear would be quieter in operation than would be the case with the "green" or hardened gears.



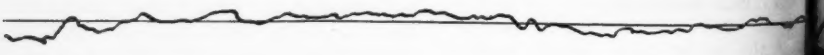
AFTER HEAT TREATMENT

Fig. 29—Chart made from gear indicated in Fig. 28 after hardening. Accumulative error is now 0.003 in.

into the fire, the accumulative error was 0.001 in. When it came out of the fire, this error had grown to 0.003 in., so that the tooth action was not as smooth as was the case when the gear was in the "green" condition.

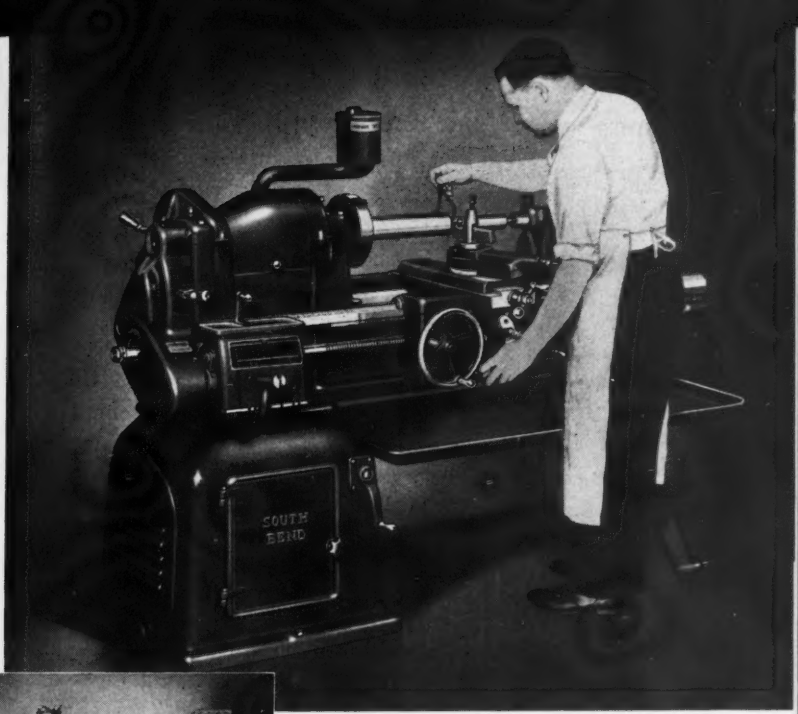
By lapping this gear on a gear lapping machine, using an internal

In Fig. 31 the readings of this gear in three conditions, "green," hardened and lapped, are all placed on one chart for comparison. Note that eccentricity is practically the same amount in the "green" and lapped gear. There is, however, some improvement in smoothness of tooth surface, and a decided improvement



AFTER LAPPING

Fig. 30—Same gear after being lapped with an internal gear-type lap.



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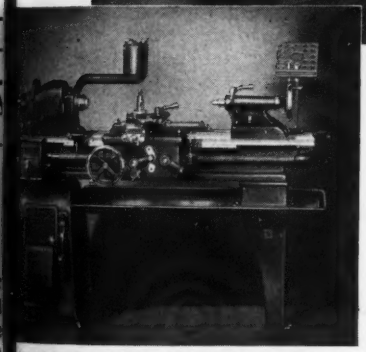

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in all respects over the hardened gear.

The charts previously shown were all made on spur gears. Helical gears, if properly cut and mounted, show a decided improvement in action over spur gears. This is largely due to the fact that in helical gears contact is progressive across the face of the tooth and is continuously at the pitch line in some one plane.

Obviously, helical gears should operate more smoothly and quietly than spur gears, and as a matter of fact, such is the case. Fig. 32 shows thre Red Liner charts of a helical gear after cutting, hardening and lapping

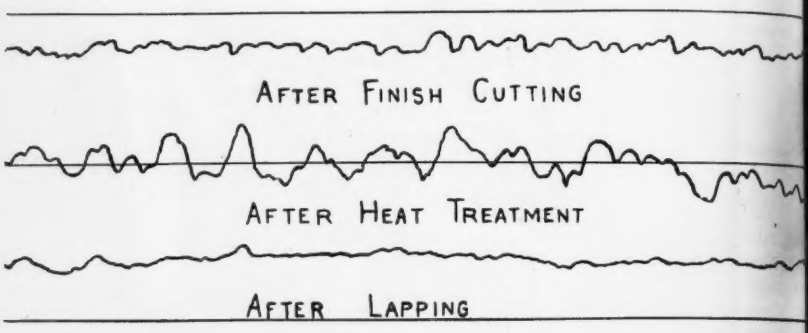

Fig. 31—Charts of the gear in "green," hardened, and lapped conditions.

Note that the lapped gear shows a considerable improvement over the hardened or the cut gear. In fact, lapping has not only improved the tooth surface, but has reduced the errors to about half of what they were orginally in the cut gear.

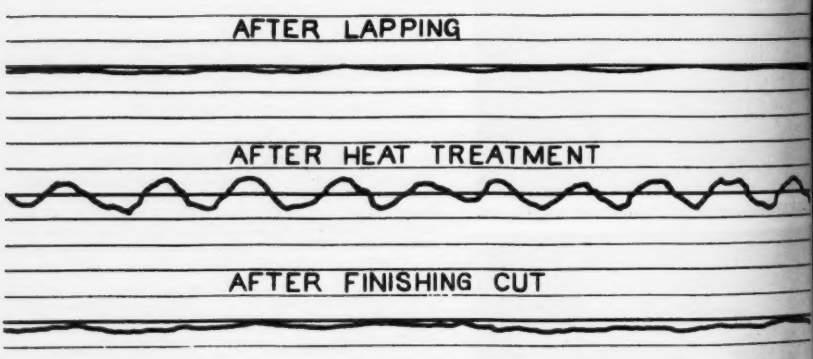

Fig. 32—Charts of a helical gear after cutting, after hardening, and after lapping.

Up to this point we have dealt principally with what might be called the measurement of the physical dimensions of gear teeth. This in pre-

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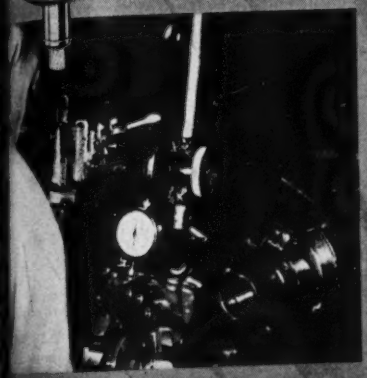

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ent-day practice is only the pre
inary stage in accurate gear pro
tion and might be considered
simply a means to and end. Much
been learned during the past
years about gear tooth action,
more particularly the relation o
tooth action to quiet gear opera
There always has been and still
considerable mystery surrounding
subject of quiet gear tooth a
Those of us who have been engag
in this work have no doubt had ca
where two sets of gears in all of th
physical dimensions appeared to
exactly alike and yet one pair
gears operated quietly, whereas t
other pair was noisy.

In an approach to this problem,
are, however, assured of one ba
fact: noisy gears are the result
vibration. If there were no vibrati
there would be no noise. In so
cases vibration is the result of u
balanced forces outside of the gea
themselves, and the vibration
transmitted to the gears. In oth
cases, the gears themselves set u
vibrations due to inaccuracies
tooth shape and other dimensions
as a result of improper mounting.

Our so-called physical dimensi
inspection will give us, in tenths o
thousandth of an inch, the variatio
in tooth elements. It will not, ho
ever, give us a satisfactory answer
the question of tooth bearing, its l
cation and area. Today, gear exper
are paying much more attention
the tooth bearing than to any oth
factor. Tooth bearing is so close
allied, however, with several oth
factors, such as pressure, tooth shap
axial alignment, and so on, that
order to get anywhere we must
necessity have control over the var
ous factors involved.

If we were dealing with but one
two surfaces, our problem would
much simpler. We are, however, de

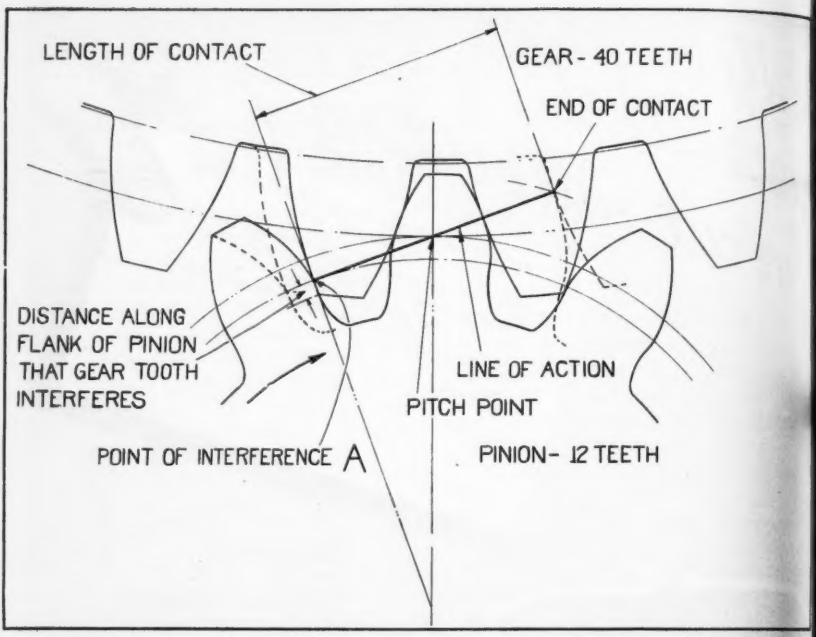

Fig. 33—Drawing of teeth of 10-pitch pinion with 12 teeth, 20-deg. angle, full length, in mesh with a gear having 40 teeth. In such a case, quiet tooth action presents a problem.

ing with a multiplicity of surfaces and these surfaces are in motion and contacting each other generally at high speed. If we consider gear teeth simply as levers of equal length with the "fulcrum point" at the pitch line, the number of levers being equal to the number of teeth on the two gears in mesh, we have a fairly accurate picture of the problem involved.

It is generally conceded that the arc of approach should be less than the arc of recession to obtain the best tooth action, and what has previously been said regarding interference evidently necessitates that the contact of the teeth in no case should take place outside the theoretical initial point of contact.

The drawing Fig. 33 shows a 10 pitch pinion of standard blank diameter, having 12 teeth, 20 deg. full length, in mesh with a gear of 40 teeth. Contact takes place in advance of the interference point A on the line of action, and we are in for trouble. The question of quiet gear tooth action, therefore, is to some extent tied up with design, because there are certain definite factors which must in all cases be carefully considered. As design is more or less controlled by the application or use to which the gears are to be put, it is beyond the scope of this article. I simply bring this point up to show one of the pitfalls that should be avoided in laying out a set of gears to obtain the best possible action.

There are, in this particular case, five solutions to the problem:

1. The outside diameter of the gear can be reduced to the point where it does not interfere with the flank of the pinion tooth, retaining the same ratio and center distance.

2. The ratio can be changed to use a pinion having a greater number of teeth; this will also affect the center distance.

3. The pinion can be cut oversize and the gear cut undersize a proportional amount, retaining the same ratio and center distance.

4. The pressure angle can be increased, retaining the same ratio and center distance.

5. The pinion can be enlarged by cutting say 12 teeth in a blank suited for 13 teeth. This will retain the same ratio but will increase the center distance.

It will be noted that the gear tooth "hooks" into the flank of the pinion tooth for a considerable distance inside the point of interference and thus will prevent proper tooth action. The position of the pinion and gear teeth where interference commences is indicated by the dotted outlines.

During the past five years the automobile industry, which is probably the largest producer of accurate gears in the country, has changed over almost entirely from the use of spur gears to helical gears for automobile transmission application. This change was not made because helical gears can be made cheaper; it was made with the object of obtaining quieter action.

If we investigate the action of a pair of spur gears, it is easy to see that quietness of action is almost impossible of obtainment for the reason that just as soon as wear takes place, the tooth shape changes. This is due to the fact that the teeth wear at those points where they slip upon one another, and a spur gear, instead of "wearing in" to shape, wears out of shape. This is not true with a helical gear, especially when the latter is made so that the advance of the helix in the face width is equal to or greater than the circular pitch. With a helical gear designed along these lines, the gears are cont- ally in contact at the pitch line some one plane, the result being t the teeth do not have an opportun to wear out of shape in the sa manner as a spur gear, and he will remain quiet much longer.

Other problems are introduced i the application of helical gearing, that instead of dealing with a pla involute surface, we are dealing wi a combined involute and warped su face, or involute helicoid. It is ju as important to have the prop bearing on a helical gear as it is a spur gear, for the reason that w can consider a helical gear simply a a multiplicity of thin or laminat spur gears, each lamination being s off in advance of the other in a heli corresponding to the helix of a hel cal gear.

In order to obtain the full advan tage of the nature of a helical gea it is necessary that we get the tooth contact across the face width of th gear or else we do not obtain wh called "helical overlap."

The final test on gears for hig speed operation is what is known i the shop as a speeder test. Mati gears which are to operate togeth are held on rigid shafts located a the exact center distance at whic the gears will be held in the assem bled unit. One of these shafts i driven by a motor or by some othe means, the power being so applie that vibration from the motor, or th drive, is not transmitted to th gears. Usually red lead is placed o one of these gears and the other eith left plain or coated with Prussia Blue. They are then rotated togeth at high speed, both with and witho braking pressure.

It is interesting to note in makin one of these speed tests that a pai of gears when running light or with out load may not have a tooth bear ing that extends from the base circl

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to the tip of the tooth, and yet, when a brake is applied to the driven gear, the bearing area spreads out, running closer to the top of the tooth. Efforts have been made to measure the difference in the shape of the tooth between one giving a full bearing under

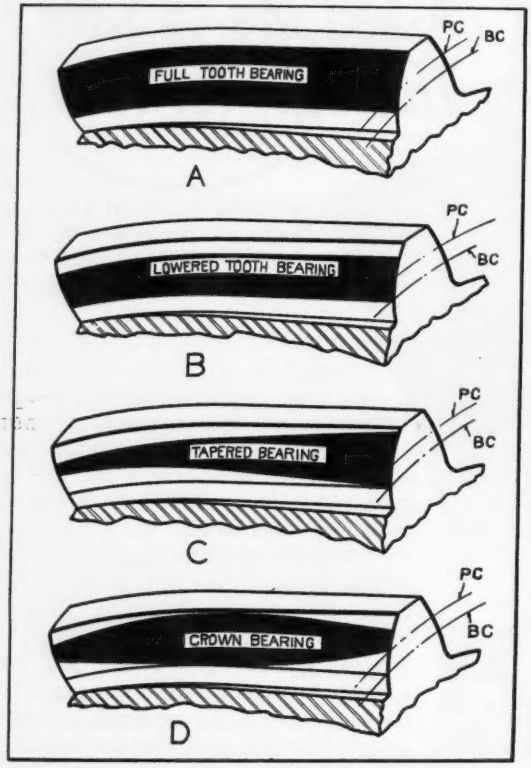

Fig. 34—Sections of four helical gear teeth showing different kinds of tooth bearings.

load and another with only a partial bearing when running light, but so far no means has been found by which this difference can definitely be determined.

As an illustration of what a bearing is, assume that we place a cylindrical bar between the centers of a grinding machine, this bar being of sufficient proportions so that it w not be deflected by the wheel, a then we traverse the wheel back a forth until it has stopped sparkin Without changing the position of t wheel as far as in-feed is concerne we remove the piece from the ce ters and lay it on the benc Then after it has cooled o we again place it on the ce ters and start the wheel tr versing. It will be noted th the wheel starts sparkin again, but that the wo shows eccentricity. So far, has been impossible to mea ure the amount of eccentri ity but we know that it e ists. This indicates in a ge eral way what we are a against in connection w the testing of bearings gear teeth. Just a sli change in the pressure volved spreads the bearin Whether this is due to t compression of the mater or to tooth deflection is a d batable question, becau even a slight load chang the height of the bearing the tooth.

In Fig. 34 are illustrat sections of four helical ge teeth, indicating what meant by various kinds tooth bearings. At A is "full" bearing extending fro the base circle to the top the tooth and across the e tire face width. At B t bearing is lowered by a mo ification at the tip of the tooth. At a tapered bearing is shown, wh would result either from the shafts on which the gears were held be out of line or running two gears gether of different leads. At D shown a "crown bearing," which recently come into prominence in c nection with production of helical ge

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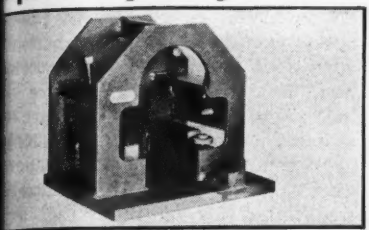

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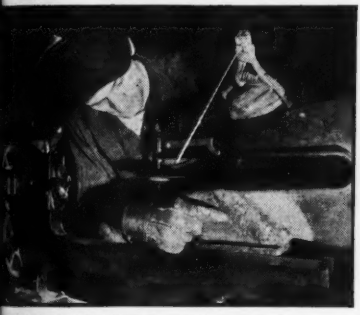

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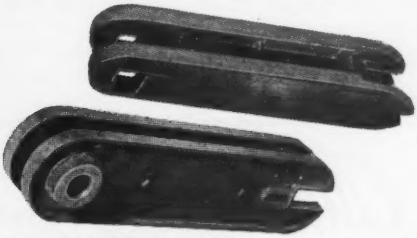

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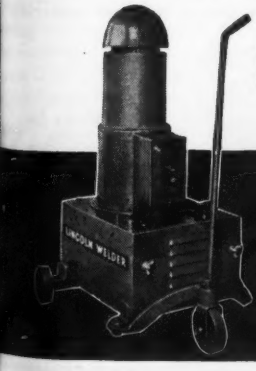

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It is contended by some that by confining the bearing to a full length bearing in the center of the gear and then letting it taper out gradually towards the ends of the teeth, as shown, that so-called "hooking" is avoided, which some claim results in noisy operation. This may be so, although it would appear that shaft misalignment is more responsible for hooking than the location of the tooth bearing. It has been demonstrated very conclusively in automotive practice that a gear tooth of the helical type, when produced so that it develops a full tooth bearing under load on the drive side and a lowered tooth bearing on the coast side, is the quietest possible gear.

Gear men have different reasons for wanting the tooth bearing located as shown at **A** and **B** on the drive and coasts sides of the teeth, respectively. It is generally believed that as the teeth pass through mesh under load, the teeth deflect and interference takes place between the tip of the rear face of the contacting tooth and the forward face of the advancing or mating tooth. If the same amount of backlash, however, was used in helical gears as has been customary with spur gears, this might not happen, but as improvements are made in manufacturing methods, the amount of backlash permissible has been gradually reduced so that today about 0.002 to 0.003 in. backlash is a maximum for 8-pitch full-length tooth gears.

In some cases the permissible backlash is even less. This necessitates, of course, gears which are accurate as to spacing and with a minimum of eccentricity of the pitch circle. If it were possible to make gears absolutely accurate as far as spacing and concentricity were concerned, they could be operated together with practically no backlash

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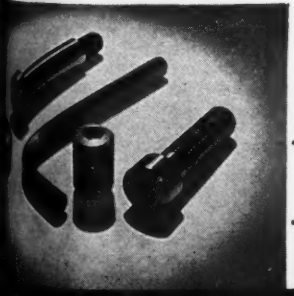

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Socket Screws

THE HOLO-KROME SCREW CORP., Hartford, Conn., U.S.A
British Representatives:
Geo. H. Alexander Mchy., Ltd., 82-84 Coleshill St., Birmingham

except for the question of lubrication. Backlash is introduced largely to take care of manufacturing and assembling errors.

Materials Handling Problems. A 4-page booklet entitled "How Handling Problems Have Been Solved with American Monorail" presents in pictorial form many solutions to industrial handling problems. The various types of tracks made by American Monorail Company, 13107 Athens Ave., Cleveland, Ohio, are described and illustrated. The major part of the booklet is devoted to photographs which show "American Monorail" overhead handling equipment installed in many different kinds of industrial plants.

Copy free upon request.

The "Compar" Combined Indicating Micrometer and Comparator, which is said to combine into one compact instrument both an improved micrometer and the equivalent of a set of solid tolerance gages covering a wide range of dimensions, is the subject of a six-page illustrated circular distributed by George Scherr Company, Inc., 130 Lafayette St., New York, N. Y.

The details of construction are discussed and information is given on the use of the "Compar" for regular measuring and also for quick checking of pieces in process or quantity inspection. Copy free upon request.

Parker Vises, product of The Charles Parker Co., Meriden, Conn., are the subject of Catalog No. 60 issued by this firm. The units presented include Parker's "Superior" and "Eclipse" Machinists' Vises, "Big Bear" Service Vises, "Victor" Swivel Jaw Machinists' Vises, Double Swivel Vises, Combination Pipe Vises, Small Anvil Vises, Filers' Vises and "Oriole" Vises. A listing of repair parts and prices is given. Copy free upon request.

Landis Chaser Grinders and Chaser Grinding Fixtures. Bulletin No. A-87-1 comprising eight pages of descriptive matter and illustrations covering Landis Chaser Grinders for grinding Landis Tangential Chasers and grinding attachments for these grinders, is now being distributed by Landis Machine Company, Inc., Waynesboro, Pa. Copy free upon request.

Job Shop Expansion Du to Modern Methods

By L. A. PEIREZ
Sales Engineer

INVESTIGATION indicates that there are approximately 15,000 jobbing and tool shops in the United States today, and it is interesting to note that the histories of the origin and development of these shops are remarkably similar. In nearly every case the owners are skilled toolmakers with years of experience behind them. As a rule, the shops are m erately financed, employ a small fo of mechanics, and have only the m essential machines, which necessar limits their possibilities.

Model J Doall Contour Sawing and Filing Machine in operation in the shop of the Brooklyn Mica Die Company, Brooklyn, N. Y.

In some cases the proprietors wo along with their employees, overloo ing the point that sales effort wou be of more value to the business th their time in the shop. , Every m shop owner would like to see his bu ness grow, but too often he is a be ter mechanic than business man a his business is limited by his sh range of vision. However, occasio ally such an owner finds the answ to the problem of what to do w his shop, and it is with such a m that we deal in this article.

The Brooklyn Mica Die Compa Brooklyn, N. Y., was organized so three years ago by Kurt Promni and Henry Hohmann, both of wh are skilled toolmakers. At the beg ning they were mainly interested the fabrication of mica and film di and small precision tools, and th equipment was selected especial for this work. However, the develo ment of good will through good wo slowly but steadily increased th business to a point where an increa in production facilities became nec sary. And, like other small concer of this kind, their capital limitatio made it imperative that the ad tional equipment be selected with view to obtaining the maximum pr


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The machine tool market asks for more pieces per hour. The machine tool asks for higher speed and more automatic control. The machine designer asks for ideas.
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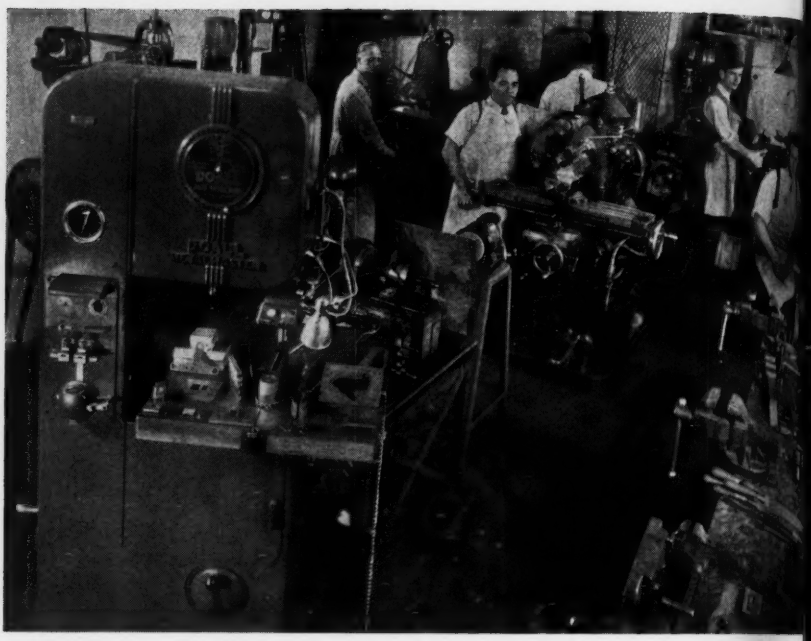


Interior of Brooklyn Mica Die Company's shop.

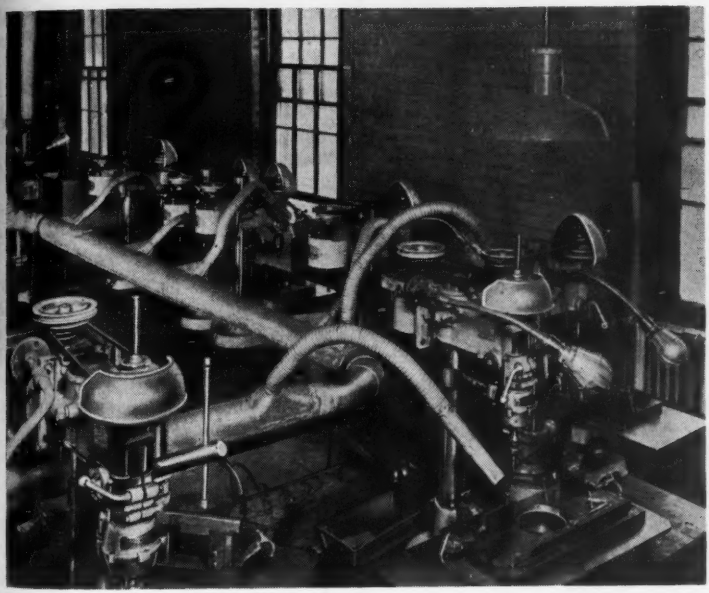
duction efficiency with a minimum expenditure. The amount of money available was insufficient for the purchasing of all of the machine tools that seemed necessary, nor was there enough floor space to accommodate the extra machines.

Among the dealers with whom they discussed their problems was the factory representative of Continental Machine Specialties, Inc., who suggested that a Doall Contour Sawing and Filing Machine be set up in their shop to see how much of their work it would handle. This was done, and it was found that with a modern contour sawing machine of this type, many operations could be performed that previously had been allotted to other types of machines. The demonstration proved conclusively that the installation of such a machine would make possible the handling of a much wider range of work than had been possible previously.

It was found that contour machining would eliminate the need for many of the milling, shaping, boring, and drilling operations that had been necessary in the production of die parts, and that production on such parts could be increased with a corresponding decrease in costs. Lower prices and better deliveries attracted more business, including orders from competitive firms who were themselves unable to meet delivery and prices because of slower and more costly production methods. A steady business developed on the contour machining of dies, jigs, tools and other parts for competitors who found it cheaper to eliminate the more expensive operations in their own shops.

Within six months after the installation of the Model J Doall Contour Machine, the business of this shop had increased to a point where orders

How To Cut YOUR EQUIPMENT COSTS



Do you want to speed up production and reduce costs—without investing many thousands of dollars for new machinery? Here's a practical suggestion: There are many operations in your shop that can be handled more efficiently and economically by low-cost tools—by Delta drill presses that cost from $26 to $275, Grinders, from $46 to $84, Metal-Cutting Band Saws at $79.50. Thousands of America's leading industrial concerns, including the largest, are using Delta low-cost tools to cut their equipment costs. Huge automotive factories, aviation and motor plants, small part makers, plastic plants—every conceivable type of manufacturing plant is found on the list of Delta low-cost tool users. If these concerns can use low-cost tools to advantage—so can you!

Send for Catalog

giving list of users, detailed descriptions of the complete Delta line and prices—and full information on how you can try any Delta tool in your shop without cost or obligation.

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were coming in for tools and dies for the silversmith industry, from cutlery and hardware manufacturers, for camera parts, and so on. This added work was more than the one machine could handle, so a Metalmaster was added to the equipment. This is a larger machine, with a greater speed range, an automatic butt welder, and the flexibility necessary to handle large work as well as the small precision parts found in the average tool and die shop.

An important feature of the Metalmaster is the Job Selector Dial, with which the correct cutting speed for any job can rapidly be determined. Instantaneous automatic butt welding of the saw blades through the starting hole in the workpiece makes possible the quick removal of stock. In some cases, by properly supporting the cutting tool when cutting out a segment or "slug" so that the material removed in the cutting is practically no more than the thickness of the saw, the slug can be used as a punch.

One of the illustrations shows the Model J Doall Contour Sawing and Filing Machine, and the other presents a view of the shop of the Brooklyn Mica Die Company. Mr. Hohmann is standing at the milling machine, and Mr. Promnitz is sitting at the bench at the right side of the room.

Metal Stampings in Small Lots. Dayton Rogers Manufacturing Co., 2501 South 13th Ave., Minneapolis, Minn., is now offering to the trade a small lot metal stamping service without prohibitive die costs. The Dayton Rogers Service is said to be advantageous in the development and manufacture of electrical devices, radio equipment, office machines, stamped automotive products, aircraft stampings, clocks and watches, precision and scientific instruments, and so on.

Details of the service are explained in a four-page folder issued by this firm. Copy free upon request.

Employee Education Methods at Farrel-Birmingham

Concluding Section --- Method of Selecting and Training Student Engineers for Executive Positions

By WALTER L. TANN
Planning and Control Engineer, Farrel-Birmingham Company, Inc.

WITH the increasing mechanization of all industries, and the consequent complexity of the heavy machinery which constitutes our line of products, it became apparent to our management a few years ago that the future key-men of our organization must be graduate engineers or the equivalent. As in most metal trades industries, the branch of engineering science that forms the basis of our work is mechanical engineering. While the industries we serve are for the most part in the field of chemical processes, such as the rubber, paper, sugar, and paint industries, or in the metallurgical field such as the steel, copper, brass, aluminum, and lead industries, we find that technical knowledge required to properly serve these and kindred fields can be interpreted in terms of mechanical processes and equipment.

The specific chemical or metallurgical knowledge that must form a part of the education and experience of the chemical engineers or metallurgists employed by these industries need not necessarily be a part of the education and experience of our engineers, whether acting as sales representatives in the field, designing engineers in our engineering department, or as production executives in our plants. This statement should not be interpreted to mean that a knowledge of the processes involved in the manufacture of rubber products, for instance, is not necessary or desirable, because it is highly important. But the graduate chemist or chemical engineer would necessarily have had to confine himself, while taking his college training, to a few basic principles of mechanical design and methods of manufacture while majoring in the basic chemistry and chemical processes.

Therefore, we find that having mechanical engineering as a basis, a sufficient knowledge of the manufacturing processes of the industries which we serve can be obtained by means of motion pictures, lectures by our department heads who are familiar with the processes and problems of a particular industry, and later, as time passes and experience broadens, by actual contact with and observation of the particular industry itself.

Method of Selection

In order to provide technically trained men for future key-men for our organization, we select members of the graduating classes of prominent technical schools and colleges. Young men are chosen who have been successful in completing either the Mechanical Engineering or Engineering Administration Courses. Correspondence is constantly being carried on throughout each year with those members of the faculty of the engineering schools who are responsible for the placement of the current graduating class, and each spring a committee composed of our department heads visits various colleges and interviews the most likely candidates.

Close attention is paid to the scholastic standing of candidates, but this qualification is subordinated to the necessity for a pleasing personality and a record of being able to get along well with their fellows. "Brain Trusters" who can think only in terms of mathematics and applied mechanics, and who neither understand their fellow-workers nor are understood by them, are poor material from which to build future key-men.

The young engineers who have been interviewed and who express interest are next invited to visit the offices and plants and are taken on a tour of inspection, not only of our plants, but of the town and environs. This inspection visit is usually made by only one prospective student engineer at a time, so that careful notes and comments may be made of his reactions, both expressed and implied.

Assignments

If the candidate is accepted, he begins work in the engineering department where he makes simple detail drawings and familiarizes himself with the system by which orders are entered, the routine of design, preparation of engineering order sheets, and in general becomes acquainted with the office personnel and with company practices. He spends six

Main Bay of Farrel-Birmingham Machine Shop, in Which the Student Engineers are Trained

months here and during that time, if he has lived up to the evaluation made by the management at the time he was taken on, has oriented himself with respect to the company, its methods and products, and his fellow-workers. The student engineer's next assignment is in the pattern shop, where he becomes familiar with the practical problems of pattern making and their relation to the drawings issued by the engineering department which he has just left. Some actual pattern work is done, but the main thought is for him to co-ordinate in his mind the relationship of the pattern shop and its work which, of course, involves pattern storage and records, with the plant activities as a whole.

He next goes to the foundry, where he does some actual work on the preparation of molds, the making of cores, and the actual production of castings. It is difficult, from the standpoint of training a student engineer, to definitely separate the pattern shop activities from those of the foundry, as they are so closely tied together in the every day operation of the plant. The principal value of the time spent in the foundry will be obtained from observing the commercial application of the principles and theories involved in the production of castings, regarding which the student engineer was schooled during his mechanical engineering training at college, and to evaluate this knowledge in terms of its relation to the manufacture of heavy machinery.

Six months is the length of the period devoted to pattern shop and foundry and during that time the student engineer learns not only of the problems involved in these departments and their commercial solutions, but also something of the shop personalities with whom he has worked.

The machine shop becomes the next training post, and here the young engineer becomes familiar with machine tools, economical set-ups, the various machining operations necessary and the parts that go into our varied line of products and also acts as a contact man between the shop and the engineering department. As in all shops, questions arise during the course of the day's work as to permissible variations from drawings for one reason or another, and here the student engineer acts to get the proper responsible persons together to discuss the matter. In no case does he act as judge as to what should be done, although in a simple case he may transmit the decision of the engineering department to the machine shop superintendent or to the foreman concerned.

In this manner he learns much of the practical side of machine shop management and, as in the case of his tour of duty in the pattern shop and foundry, sees the relationship between the engineers and the shop in a practical light.

For over one hundred years one of our important lines of products has been chilled iron and alloy rolls for the plastics, copper, metal, paint, and cereal industries, and a separate department is devoted to their manufacture. Here the student engineer is next placed for a period of six months so that he will learn of the processes and techniques involved in the making of these highly important elements of process machinery. The requirements are fairly simple compared to some present-day production problems, but extreme quality and accuracy are absolutely essential. While on the roll shop assignment, the young engineer has an opportunity to gain experience in the various phases of manufacture of these important parts of our complete machines, because not only do

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Hannifin Pneumatic Arbor Presses for production press-assembly, broaching, piercing, keyway cutting, oil grooving, straightening, pressing, molding, and similar work.

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Cylinders are bored and honed, producing a smooth, round, straight bore. Perfect piston fit in an accurate cylinder bore means maximum power—no leakage, and minimum friction loss.

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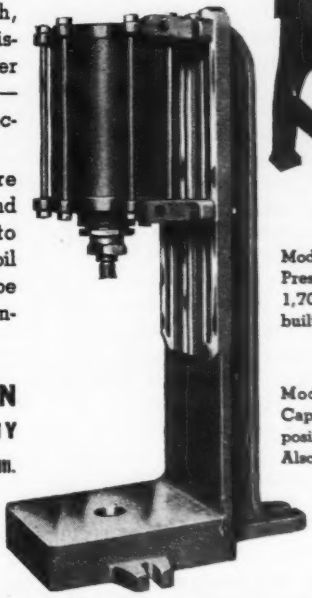
Model B-2 steel frame Arbor Press. Built in capacities from 1,700 lbs. to 18,000 lbs. Also built for bench mounting.



Model AO-1 Arbor Press. Capacity 2,650 lbs. Cylinder position adjustable in frame. Also built in other capacities.

HANNIFIN MANUFACTURING COMPANY

621-631 South Kolmar Ave., Chicago, Ill.

Write for new Bulletin 46-MM

ENGINEERS · DESIGNERS · MANUFACTURERS · PNEUMATIC AND HYDRAULIC PRODUCTION TOOL EQUIPMENT

finished rolls enter into the machinery built for the process industries, but the roll shop production facilities are used on certain elements of other machines, such as final grinding of rams for hydraulic presses, grinding journals on shafts for various machines, and so on.

Three months are next spent by the student engineer in the metallurgical and welding departments where he gains experience in metallurgical control and the procedures and techniques involved in making weldments for machine bases, bedplates, all-welded gears, reduction gear housings for commercial, marine and naval applications, and also gear guards and other lightweight welded work. He becomes familiar with metallurgical and other test requirements of Lloyd's, American Bureau of Shipping, and United States Navy Inspection.

In addition, the student engineer is brought in contact with the practical applications of flame hardening and the technique of applying hard overlays of stellite and other materials. In short, he gets a working knowledge of the applications and also the limitations of the latest metallurgical practices and processes, and their uses in the manufacture of our line of heavy machinery.

While engaged on the welding assignment, he acts, as in the machine shop, as contact man with the engineering department and in addition, makes cutting sketches of various plates and shapes that enter into a weldment. Thus the work to which he is assigned is not only of actual productive value, but it serves to bring him in direct contact with welding operations and enables him to learn the practical aspects of this rapidly growing field.

The completion of his assignment in the metallurgical and welding departments brings to and end the student engineer's course of training with respect to actual production processes. His next transfer is to the planning and control department for a period of three months where he works successively for a period of one each in the production, estimating, and methods divisions.

Although he has been made familiar by contact with the work of these divisions while assigned to various shops, he now does actual production control work by contacts with the sales and engineering departments and with the various shops. He becomes familiar with the details of production scheduling and follow-up, not only in the shops, but of outside vendors through the purchasing department, and through work in the machine shop control office gains actual experience in getting successive operations performed in sequence on the various machine tools to which the parts have been routed.

He spends one month in the production division and from there goes to the estimating division, where he is given the opportunity to make small estimates and perform other duties that familiarize him with the procedures involved in preparing estimates for the sales department. After one month here, the student engineer in assigned to the methods division, where he works with methods engineers in establishing standard times and practices for set-ups and machining, and in general makes himself useful compiling data and results of operation studies.

His last assignment is the cost department, where his work covers not only the usual field of compiling costs, but of computing payroll, social security and unemployment insurance, and fair labor standards act records. The issuance of controlling reports and the preparation of other data for the management are also

done by this department. No attempt is made to do more than to show the student engineer the broader aspects of this department, but it gives him a clear insight into what reports and summaries are prepared and how they are prepared. One month is spent here, and at its completion the formal training of the student engineer is finished.

Benefits of Training

From the foregoing it will be observed that the student engineer, upon completion of the training, possesses a knowledge of all of our manufacturing operations that would not be possible to equal if he were given employment in some one department upon graduation and left to circumstance and his own initiative to gather the equivalent information. To the basic training received in his technical school he has added a broad knowledge of the applications of this essential theory to the practical commercial work of the heavy machinery industry and with the specific techniques and practices in use in our shops.

The student engineer's aptitudes for a particular phase of our business have had plenty of time to develop, so at the end of his training period an effort is made to permanently place him on work for which he shows a definite fitness and liking. This, of course, must be governed by conditions prevailing at the time he completes his training, as it is not always possible to place him at once in the department of his choice or on the work for which he is pre-eminently fitted. However, his training history is recorded and he is put on the reserve list for ultimate placement on that work.

All student engineers are members of the evening study group (to be discussed later), and through the weekly meetings and discussions

they are brought into close contact with company practices and personnel. Most of them have had college courses in the same field and on the same subjects covered by the studies of the group, but the discussion of the application of the principles in our own organization shortens their period of orientation with and assimilation into our organization as a whole. Three members of a previous training group which operated under a more limited assignment program than our present course are found today in the following positions: head of production division; methods engineer, and sales engineer. We have every reason to feel that with the breadth of training now given that we will find equivalent material among those now working under this present training plan.

Training in Principles of Work Simplification

With a constant supply of new mechanics coming along as graduates of our apprentice training course, with new blood entering the organization as student engineers, and with the educational activities of the evening study group, it might well be said that we are making a good effort to insure ourselves against the future man-power requirements of the business by providing a reservoir of trained personnel to fill almost any conceivable demand. The apprentices are schooled and experienced in the techniques and craftsmanship of their trades; key-men and junior executives, through the study and discussion group, gain a well-rounded knowledge of the principles and application of industrial management; student engineers become familiar with the work of every department and add to their basic engineering training the advantages gained by their attendance and participation in the discussions of the study group.

Internal Testing

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HARDNESS TESTER

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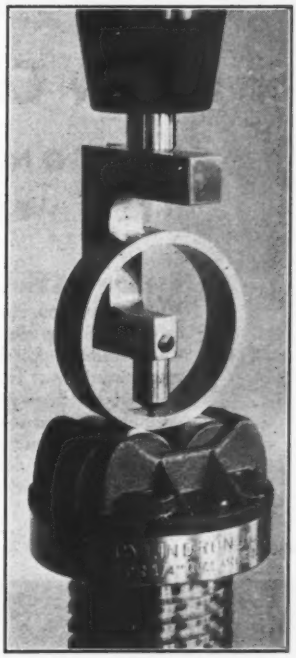
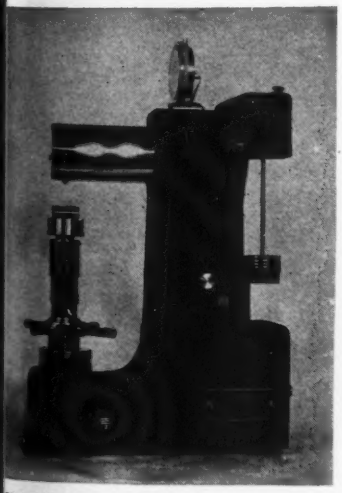
We make many standard, semi-special and special machines for testing inside cylindrical surfaces. Our field organization is in the field just to discuss your needs with you. Let them do it.



Goose Neck Adapter 1503 useable in any "ROCKWELL" Hardness Tester or "ROCKWELL" Superficial Hardness Tester.



Model 3-CR or 3-CS for testing inner surfaces of large cylinders.

Hundreds of our customers are using the adapter shown above. The leading makers of aircraft engines test their cylinders with our equipment shown at the left. What do you need?

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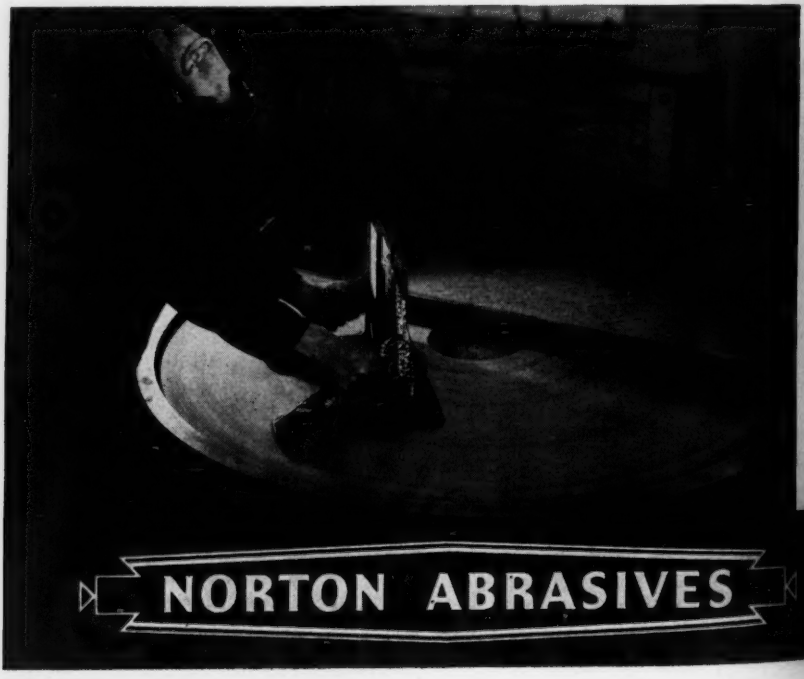
MADE of either Alundum or Crystolon abrasive — whichever your job requires — and using special resinoid bond formulae developed by the Norton research laboratories, Norton Resinoid Discs are cutting surfacing costs for many concerns. The open structure made possible by the resinoid bond gives a fast, free cutting action and the patented controlled structure process assures uniformity throughout each disc and from disc to disc. Available in solid and segmental types in mountings and sizes to fit all makes of horizontal and vertical spindle disc grinders.

W-699



For Economical Cutting-off . . .

NORTON RESINOID BONDED CUT-OFF WHEELS

CUTTING-OFF and slotting are now real production jobs and the Norton Resinoid Cut-off Wheel is a real production tool. In many plants where careful records are kept this wheel shows the lowest cost per cut. It also reduces the amount of stock lost in machining and finishes the cut so well that in many cases subsequent machining is not necessary. For many wet cutting operations and for jobs where a minimum of burr is desired there are also Norton rubber bonded cut-off wheels. Norton engineers are available to study your cut-off jobs and recommend the correct wheels.

W-700

Thus far we have concerned ourselves with HOW to do the work required—now let us describe a program aimed at a study of the ONE BEST WAY to do the work.

Training Program Begun

About a year ago a program was instituted under the leadership of Mr. Allan H. Mogensen to find the "one best way" through a study of the principles of work simplification. Three groups of foremen and junior executives met under Mr. Mogensen's leadership during working hours and at such time as was most desirable for the personnel involved, and in the evening, all senior executives from the president down met at a dinner meeting. One day every other week was devoted to this program, which began in September and ended in June.

Realizing at the start that the very nature of our product and method of production; i.e., making heavy machinery on the job-order basis, precluded the adoption of some of the methods and mechanisms used profitably in mass-production plants, we aimed our program at the "one best way" to do our work. All attending the meetings were instructed in the six basic questions that must be answered before the "one best way" can be found. These six questions are:

1—WHY should the work be done?
2—WHAT is to be done?
3—HOW is the work to be done?
4—WHO is to do the work?
5—WHERE is the work to be done?
6—WHEN is the work to be done?

To answer these questions required an analysis of the operation being studied, and finding the correct answers to all means "a better product at a lower cost—and at the right time."

"DYNO-MITE" DOUBLES PRODUCTION

MINIMIZES FATIGUE

They gave the little lady a rest...*and found that she worked twice as fast.* In the actual case pictured above, the slower hand-powered screw driver was retired from this assembly job, and the powerful, delicately-adjustable DYNO-MITE was put to work. Its ADJUSTOMATIC Clutch — exclusive Millers Falls principle — affords perfect torque control over a wide range; its high quality construction keeps its performance dependable. Aren't there a few girls in *your* plant who'd be glad to *double* their production with DYNO-MITE? Ask your supplier to arrange a free trial, and write today for further information.

Dyno-Mite Screw Driver.

10" long, weight 3 pounds.

Sure one-hand control.

MILLERS FALLS TOOLS

MILLERS FALLS COMPANY GREENFIELD, . . MASS . .

How the "One Best Way" Is Found

In investigating and analyzing the movements and operations involved in manufacturing an element of a machine, there is nothing better than the well-known "process chart" which shows progressively the movements, storages, operations and inspections for a particular piece of work from the time it is received as a rough casting, forging or weldment until it leaves the department being studied. The distance traveled between the various machines and storage spaces can be shown in terms of feet and in general a well-nigh perfect picture can be obtained of the time, distances and handlings involved.

All attending the meetings were instructed in the meaning of the symbols and method of preparing process charts. All participating in the program were required to make up and submit a process chart covering some every-day duty such as "shaving," "building a furnace fire," and so on, showing "present method" and improved "proposed method," indicating the number of feet traveled, number of operations, and so on, that might be saved by adoption of the proposed improved method.

From these elementary beginnings, the program progressed to definite assignments on actual process charts, showing the present operations and travel of actual parts in process in our shops, and paralleling the chart, showing the present method, was shown a chart involving a new and improved proposed method. Plans were under way at this time for important building additions and revamping of the layout of our foundry and application of these principles of work simplification was of great help in obtaining a practical work and space-saving layout.

One particularly worth-while assignment was a study of a certain

group of machine tools over which passed a good percentage of relatively small parts entering into several widely different lines of products. Process charts used in conjunction with layouts showing existing machine tool locations demonstrated clearly the advantages that would be gained by shifting the "center of gravity" of these many operations, by moving a few tools that were located away from this natural center of flow of the work.

To make permanent records of the changes found to be desirable and to sustain interest, motion pictures were made of the "old method" and then, upon installation, of the "new method." These films were shown at all meetings and added to the proof of accomplishment.

Results

Probably most readers are familiar with the usual principles of work simplification, so no attempt will be made here to discuss the training program in any further detail than already given. Suffice to say that at the completion of the program, sufficient proof of its value was available to warrant the assignment of a methods engineer to continue the work in the shops.

The senior executive group, meeting in the evening of the day devoted to the program, was productive of much worth-while discussion and kept all executives informed of the program's progress among the foremen and others upon whose efforts in applying these principles to the actual work in the shops depended the success or failure of the program.

Summarizing the aims of this phase of our employee education activities, it may be said that here was mass-application of modern job order production principles to our plant and products. Every man in attendance was schooled in these im-

portant factors and we have only begun to feel the benefits. Our present work simplification program, which is under the immediate supervision of one of the attendants at the program conducted by Mr. Mogensen, includes foremen's meetings on such topics as "The Security of Our Jobs," "Handling Workers Through Their Motives," and like subjects on industrial economics and psychology, and we will also include special courses for shop men in the principles of work simplification. Attendance at such courses will, of course, be entirely voluntary on the part of the worker.

Conclusions

We feel that a product cannot be much better than the men who build it and that our service to our customers will be no better than the men who have a part in rendering that service. Therefore it seems to us that along with offering products of design and construction suited to today's requirements, using machine tools capable of producing work to costs tuned to today's markets, and incorporating materials equal or superior to present day specifications we must make available to all employees educational facilities in various forms which will enable them to increase and maintain their skills and knowledge of their jobs, on a plane comparable to the machinery they build. By such a program, all will profit.

Over fifteen years ago the Federal Board For Vocational Education summed up the necessities for a program such as ours with the following statement:

> "Society, as a whole, has to pay the bill for inefficiency. Half-trained or poorly trained workers in any field increase production costs, which in turn are passed on to the consumer. Clearly the public, laborers as well as others, have an interest in securing an adequate supply of well-trained workers for every line of necessary work."

Granting the economic truths in the above statement, it is evident that a long-range employee-training program is a long step forward toward the full recognition of the "social responsibilities of industry," an implication that we read and hear of today at every hand.

CUT DIE COSTS THREE WAYS WITH STRENES METAL

Save 30% to 50% with this Widely Used Forming and Drawing Die Alloy

The next time you tool up, don't fail to specify that at least one die shall be made of cast-to-shape Strenes metal. This close-grained, long run die alloy will set new economy and performance records for you just as it has done for scores of others... for one-half the automotive firms for example.

Lower Initial Die Cost: The raw Strenes stock is considerably less costly than conventional die materials. Furthermore, by casting this chrome - nickel - molybdenum alloy to shape, machining time is greatly reduced.

Greater Resistance To Wear: Strenes metal is famous for its ability to resist wear. Several Strenes dies have produced over 1,000,000 stampings out of medium heavy materials.

Less Maintenance Expense: Strenes metal is close-grained (see illustration above) and takes a high polish. In addition, it has a high graphitic surface lubrication which enables blanks to easily slip over working surfaces without galling or "picking up."

Check into the stamping operations in your own plant. If you have a use for Strenes metal, write for full details.

THE ADVANCE FOUNDRY CO., Dayton, Ohio

Representatives in Principal Territories

STRENES METAL

FOR DRAWING AND FORMING DIES

FROM READERS

Time-Saving Adapter for Second-Operation Work

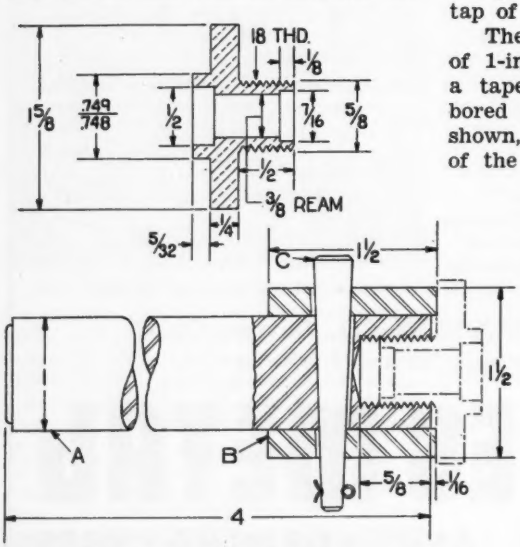
By J. B. COFFEY

THE detail in the upper part of the drawing presents the dimensions of a brass workpiece of the type that usually requires two operations for complete finishing. In the first operation the piece is turned to 1⅝ in. diameter and an 18-P. thread is cut on the small end. A ⅜-in. hole is also drilled and reamed through the axis of the piece and the end is counterbored $\frac{7}{16}$ in. diameter by ⅛ in. deep.

In the second operation, the opposite end of the piece is turned to 0.748—0.749 in. diameter and counterbored ½ in. diameter by 5/32 in. deep. To make an adapter for the second operation into which the piece can be threaded is a simple matter, but a wrench is usually required to loosen the piece so that it can be removed when finished. The adapter illustrated here is so designed that the piece can be loosened by a light tap of a hammer.

The adapter consists of a piece of 1-in. stock **A**, the sleeve **B**, and a taper pin, **C**. This section **A** is bored and threaded at one end, as shown, to receive the threaded end of the workpiece. The sleeve **B** and the section **A** are drilled and reamed as shown for the taper pin **C**, the sleeve being drilled at a point which will allow one end of the sleeve to project over the end of the piece **A** after the several parts have been assembled together.

In use, the workpiece is threaded into the end of the adapter until it presses tightly against the end of the sleeve. As it is threaded further, the sleeve bears against the taper pin **C**, and still further tightening locks the



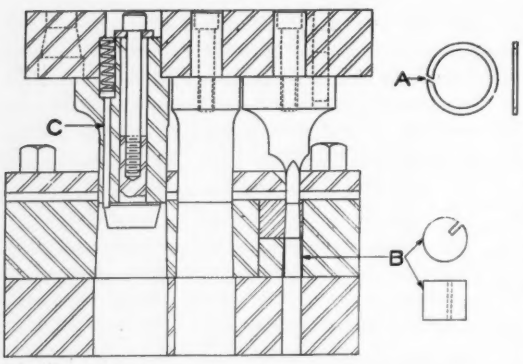
Design of Time-Saving Adapter for Second-Operation Work

workpiece in position. After the second operation has been performed, the taper pin is loosened by tapping it on the small end, removing pressure from the workpiece so that it can easily be unscrewed by hand.

"Kinks" for Die Designers

By Wm. C. Betz

IN the production of the blued spring steel rings illustrated as **A** in the drawing, we found that the job was being retarded due to the fact that,



Drawing Illustrating Use of Shedder Pins and Inserts in Die Design

in the slotting operation, the ends of the pieces were cocking. This was undoubtedly due to lack of tension of the work in the die bore, and prevented the feeding of the stock for the following blanks. A number of similar dies had been made for blanking smaller sizes of rings from thinner stock and had given no trouble, but the ring shown is over an inch in diameter and the stock thickness is 0.010 inch.

To eliminate the trouble, we drilled three ⅛-in. holes vertically through the punch and counterbored them from the back or upper ends as shown. We then made pins to fit the holes, as shown at **C**, the upper end of each pin having a head and the lower end projecting below the end of the punch so as to act as a "shedder." Spiral springs above the pins served to push them down so that they would force the rings down in the die after blanking.

Another novel feature of the die is the method of piercing the slot in the first stage of the operation. Instead of drilling and filing out the solid die, or making a button in two pieces as is often done, we made a disc of the design shown at **B** and sawed a slot of the required width in the disc. The slot did not extend to the center of the piece, however, thus it would have the tendency to collapse when the piece was driven into the main die section. Clearance was filed on the sides of the slot and the end was sawed to provide proper clearance, but no clearance was provided in the die proper, as it was deemed unnecessary.

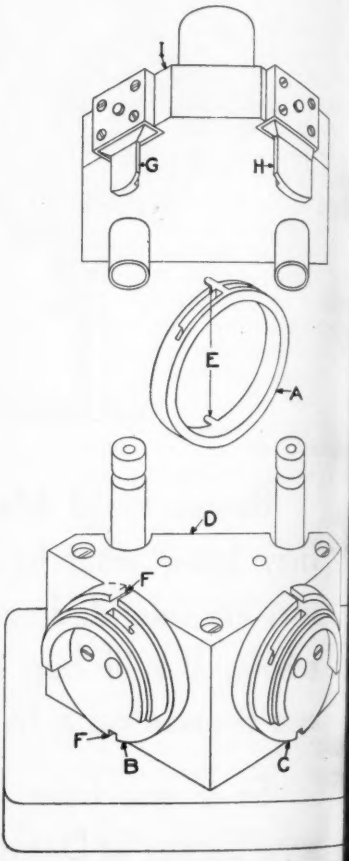
In making a disc of this kind we leave the length about ⅛ in. more than is actually required in order to afford stock for chucking. We chuck the piece in a cylindrical grinder to grind the O. D. to a drive fit in the main die piece, then the excess stock on the end is ground off and the disc is pressed into the die.

Tools For Slotting Small Meter Rims

By Chas. H. Willey

THE drawing illustrates a set of tools that were designed for the piercing of two separate slots in the piece **A**, which is a replacement rim for the Model B Ford dash ammeter. The two dies, **B** and **C**, are mounted on the die block **D** at an angle of 90

deg. from each other, and the punch G and H are mounted on the upp die member I in the same manne The workpiece A, which has be formed in a previous operation, h



Drawing Presenting Design of Dies for Punching Slots in Meter Rim

two tabs E on its rim, the tabs be provided to attach the meter rim the back of the meter.

To slot, the workpiece A is p tioned on the die B, the tabs E be located in the slots F. When the p is operated, the punch G pierce

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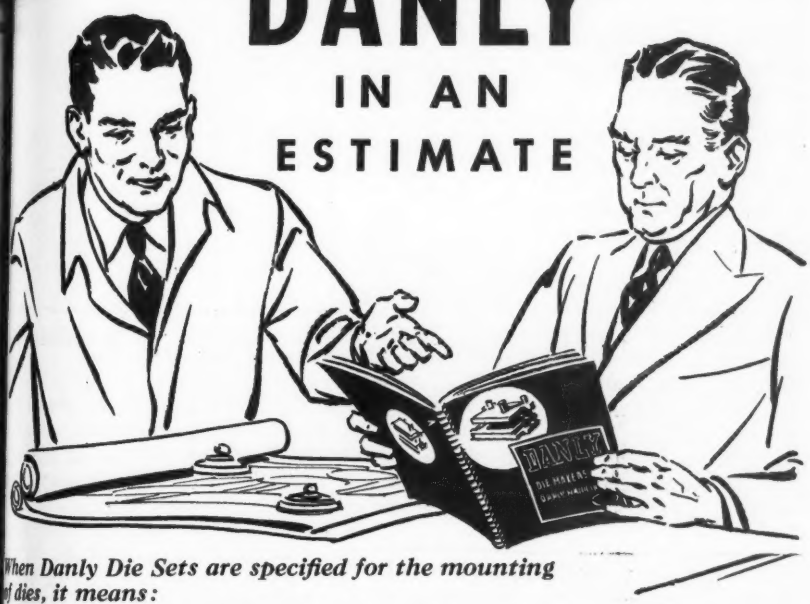
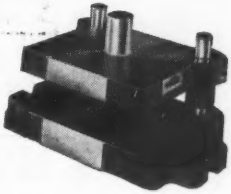
IN AN ESTIMATE



When Danly Die Sets are specified for the mounting of dies, it means:

—that the die maker is protected from lost man hours or added machining not included in his estimate.

—that the die user is protected from set-up and production delays, frequent regrinds and high stamping costs.



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DANLY DIE SETS and DIE MAKERS' SUPPLIES

Their Dependable Quality Means Lower Cost Stampings

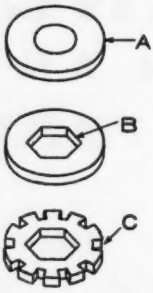
slot. The same workpiece is then located on the die C, where the second slot is pierced by the punch H. Two pieces are, of course, pierced in a single operation, producing a completed piece at each operation of the press.

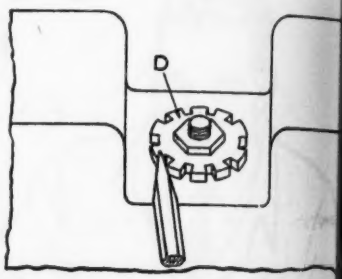
Accessory for Loosening an Inaccessible Nut

By A. H. WAYCHOFF

IT sometimes becomes necessary to loosen or tighten a nut which, because it was applied before the complete unit was assembled or because it had been threaded on with a special wrench which is now unavailable, is impossible to turn with an ordinary wrench. Illustrated herewith is a special "washer" which is designed to aid in performing this task under such difficulties.

A steel washer, A, is filed or machined out to fit the nut as shown at B, then a series of notches are cut in the edge of the washer as shown at C. To use, the washer is slipped into place over the nut, then the point of a dull chisel is inserted into one of the notches as shown at D. By tapping the chisel, the nut can usually be tightened or loosened as desired.





Steel Washer Cut and Notched for Use in Loosening or Tightening and Inaccessible Nut

Haskins Ground - From - Solid Rotary Files, made from a special grade of tool steel and ground from the solid in one piece after hardening, are described and illustrated in a folder now being issued by R. G. Haskins Company, 619 S. California Ave., Chicago, Ill. The folder also presents hand cut files, rasps, and mill cut files. Copy free upon request.

UNDOUBTEDLY the greatest single problem affecting the "life, liberty, and pursuit of happiness" of the American people today is the unemployment problem. It isn't that the needs or desires of the nation are filled; thousands of people are still without automobiles, radios, mechanical refrigerators, comfortable homes, and many other necessities and conveniences denied to them by lack of income through unemployment or fear of the loss of employment.

People cannot buy without money, and money comes to the majority as compensation for services rendered. When the opportunity for service fades, business lags, business failures increase, people without work are forced to accept charity, and people who are fortunate enough to have income from jobs or otherwise are forced to keep their more unfortunate neighbors. The ills that can be charged against stagnant business are of infinite number and variety.

If all the idle people in this country could be put to work, they would buy enough products of all kinds to keep our factories busy. If the factories could find markets for their products, they could hire all who want work. There may be other factors that bear on the matter, but that is the situation in a nut-shell. The problem is: How can we get the machinery of production and distribution operating at normal speed, and what is necessary to keep it running, once it is under way?

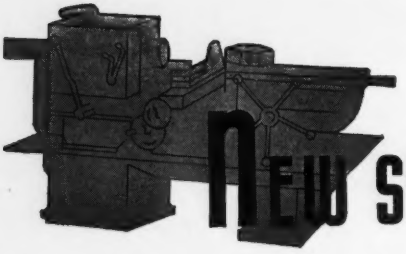
It is to the credit of the American Society of Tool Engineers that they have taken upon themselves the task of determining the effect of the development of the machine on unemployment and the standard of living. A preliminary report, delivered at the preview dinner at the recent convention and exhibition in Detroit, indicated that the fact-finding committee charged with this task is well qualified to find the answer, and it is equally certain that the answer to this question will also be the answer to other and equally important ones.

A surgeon, an engineer, and a politician were arguing as to which of their professions was the oldest. Said the surgeon, "My profession has existed since the first man. The Bible tells us that the Creator took out one of Adam's ribs and used it in the creation of Eve, thus performing the first surgical operation."

The engineer replied, "My profession is older than man. In fact, it is as old as creation, because the Bible states that the Lord brought order out of chaos, and that is an engineering task."

The surgeon was ready to agree that the engineer's profession was older, but the politician said, "Wait. Who do you think created the chaos?"

In spite of the fact that unemployment is the country's most important problem, the politicians do not seem to have made much headway with it. When the A.S.T.E. Fact-Finding Committee has completed its work on the relation of the machine to unemployment, we hope the committee will continue with the job of finding out what can be done to get idle machines in motion and reduce the unemployment. The engineers are as capable of finding the answer as any other body, and if they can discover the solution they will have rendered a service which will redound to their everlasting glory.



NEW SHOP EQUIPMENT

Gisholt High Production Turret Lathes

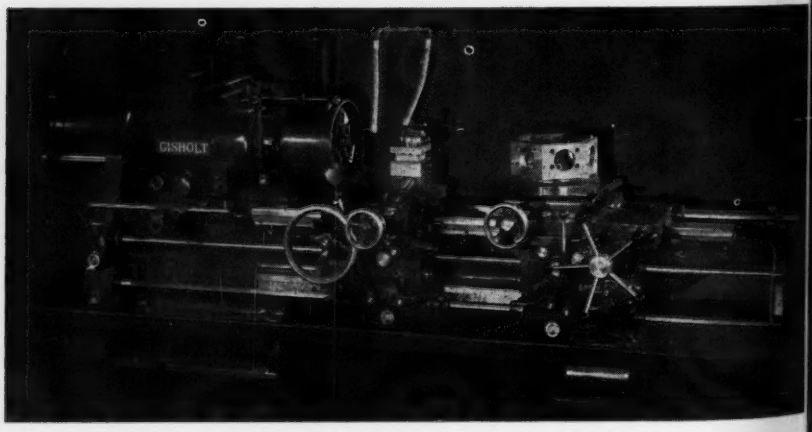
Many new refinements to improve the performance and ease of operation, increase machine life, and further extend its field of usefulness have been incorporated in the Gisholt 1L, 2L and 3L high Production Turret Lathes built by Gisholt Machine Company, 1219 E. Washington Ave., Madison, Wis. Bar capacities range from 2½ to 4½-in. diameter and from 36 to 48 in. long. The machines have a swing over the ways ranging from 19 to 26 in. and employ chucks ranging from 12 to 21-in. diameter. The machines are intended for both high production of similar pieces and small lot jobbing of various types of work, and are equally well adapted to both bar work and chucking work.

The machines have the new solid hardened steel ways, made of high carbon alloy steel and hardened clear through. The ways are ground in perfect alignment with the spindle.

The strongly braced headstock is cast integral with the bed casting, which provides an exceptionally rigid construction. Twelve spindle speeds are available, the normal range of which for the 1L and 2L machines is from 20 to 48 r.p.m. and for the 3L machine, from 1 to 333 r.p.m. All speeds are arranged in a geometrical progression.

The spindle is mounted on precision type tapered roller bearings and all shafts in the headstock, as well as the aprons, are mounted on anti-friction bearings. The gears are of high carbon chrome molybdenum steel hardened and the tooth contours are ground. The high speed gears are of the helical type. A double multiple disc clutch is used for starting and reversing the spindle and a powerful multiple disc brake automatically stops the spindle when the machine is shifted into neutral.

Sixteen reversible power feeds in two ranges of eight each are provided for



Gisholt Model 2L Production Turret Lathe

both longitudinal and cross feeds of the cross slide or the cross-feeding hexagon turret. The longitudinal feeds range from 0.004 to 0.136 in. and the cross feeds range from 0.002 to 0.068 in. on the 1L machine and 0.002 to 0.084 in. on the 2L and 3L machines. The feeds are engaged and disengaged by quick releasing type levers or the feed trips may be set for automatically disengaging the feed at the completion of a cut.

A safety shear pin in the feed train on each carriage protects the feed gears against overload due to tool failure or accident and a safety friction affords similar protection to the rapid traverses. All apron gears are made from alloy steel and heat treated.

Multiple V-belt motor drive is standard on all three machines and the motor is mounted on the top of the headstock. Standard motor recommendations for the 1L machine are up to 10 h.p. For the 2L and 3L machines, the motor recommendations are up to 15 h.p. For high speed operation, 15 h.p. motors are recommended for the 1L and 20 h.p. motors for the 2L and 3L machines. Rapid traverses are provided for the longitudinal travel of both carriages and also for the in-and-out travel for the cross slide on the side carriage. The rapid traverse levers are provided with colored knobs for the operator's convenience.

All three machines are supplied with either fixed center hexagon turret or cross-feeding hexagon turret. The fixed center hexagon turret is recommended for work occurring in sufficient quantities to employ multiple tooling, such as multiple turning heads and piloted boring bars. The cross-feeding turret is particularly efficient on small lot work where the production is too small to absorb the set-up time for multiple tooling. The cross-feeding turret may also be locked on center and used with piloted turning heads and piloted boring bars with the same effectiveness as a fixed center hexagon turret machine. The cross-feeding hexagon turret employs simple tools such as single point boring bars, single point tool holders, and so forth. Holes are bored by adjusting the turret off center the desired amount.

The headstock is automatically lubricated by a splash system, which carries oil to all gears and bearings, and the taper roller spindle bearings are oiled by a continuous flow of filtered oil from a catch reservoir in the headstock. The aprons are automatically lubricated by

an oil pump which directs a steady stream of oil over all gears and bearings and the hardened steel bed ways are lubricated under the carriages by a force feed pump which is engaged each time the rapid traverse is employed. The aprons are closed and all gears, shafts and bearings run in oil baths. The gear train which drives the feed shafts is enclosed and also runs in oil.

The available attachments include a built-in taper attachment for the cross slide, provided with a standard guide plate for cutting tapers up to 1½ in. per foot and 12 in. maximum length, or special guide plates may be furnished for tapers up to 3 in. per foot and 6 in. maximum length. Tapers may be cut at any point within the travel of the cross slide. The hexagon turret taper attachment is also available, which is of the heavy bed type design and permits cutting tapers or taper bores up to 8 in. taper per foot and 12 in. maximum length. Power-operated bar feeds are available for all three machines. A single lever here actuates the collet chuck and the bar feed. A movement of this lever forward engages a quick-acting friction clutch, which advances the bar stock by power to a turret stop. A movement of the lever backward disengages the clutch, closes the colle and grips the bar ready for machinin Thread chasing attachments are avai able for both the side carriage and fo the hexagon turret carriage.

Compound rests with power angul feed are available for all three m chines. If desired, a compound re with hand angular feed is also avai able for all three machines. In additio to this, the Gisholt Machine Compan has available an extensive line of stan ard tools and tool holders for these m chines, as well as three-jaw scr chucks and four-jaw independen chucks.

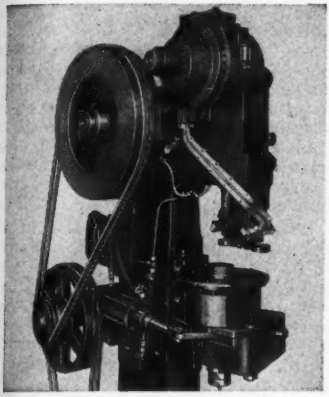
Brown & Sharpe No. 2 Vertic Milling Machine

A No. 2 Vertical Milling Machine the light type with power fast trav has been added to the line of millin machines built by Brown & Sharpe Mf Co., Providence, R. I. The machine h a capacity of 28 in. longitudinal fee automatic, and 10 in. transverse fee automatic. Vertical feed of knee is 1 in., also automatic. Actual feed of spi dle is 3 in. Maximum distance fro

the RIVITOR

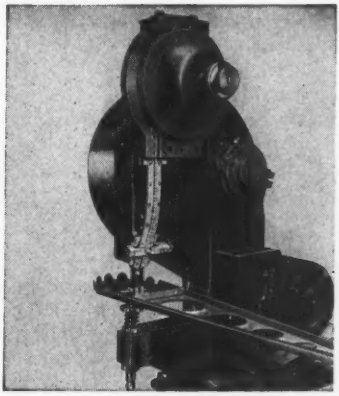
already serves these industries . . . . .

AUTOMOTIVE . . .



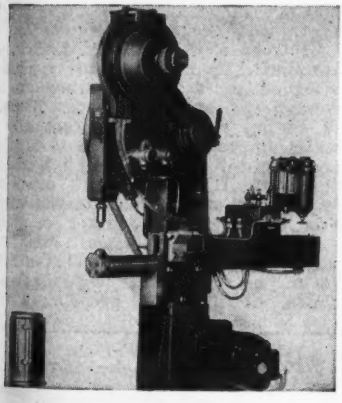
The Rivitor is shown here setting two solid rivets at one time to attach cushion springs to driven clutch plate assemblies.

AIRCRAFT . . .

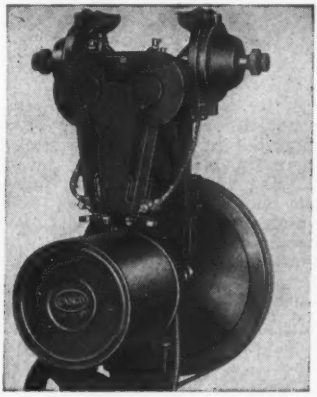


This is the standard "BR" Bench Type Rivitor tooled for setting ⅛" diameter x ¼" long duralumin rivets in airplane sections.

CONTAINER . . .



The Rivitor is shown here setting aluminum rivets to attach handle brackets to bodies of percolators.



This Rivitor sets two rivets at the same time to attach handle brackets to to paint pails.

The Rivitor ably handles not only these jobs in these industries, but many jobs in these and other industries, wherever there are solid rivets to be automatically fed and set to obtain a stronger joint—better—faster.

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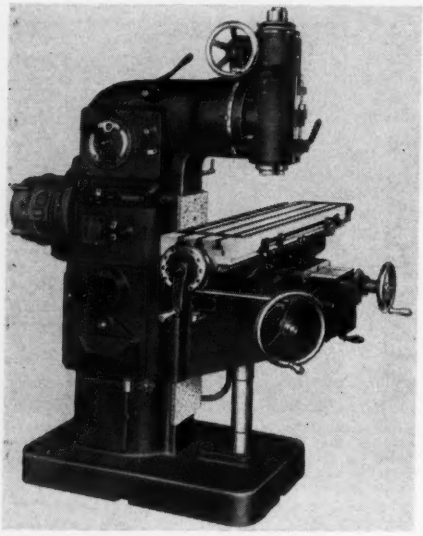
spindle to top of table with spindle vertical, 18 in.; from center of spindle with spindle horizontal, 24¾ in. Throat distance, center of spindle to face of column, 12 inches.

The machine is driven by a 3 h.p.



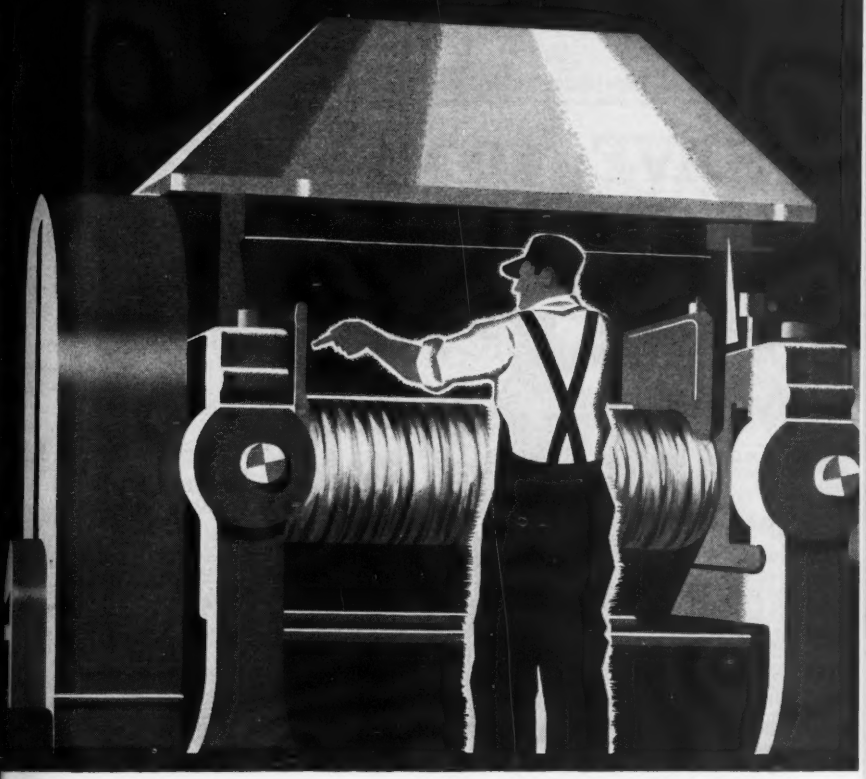
Brown & Sharpe No. 2 Vertical Milling Machine

constant speed flange type motor mounted at the rear, providing an all-gear drive. The motor is started by moving the machine starting lever and the same lever operates a brake for quick stopping. No friction clutch is used. Fast traverse in all directions is obtained by an independent ¾ h.p. motor mounted on the right side of the knee.

Sixteen changes of speed are avail able in practically geometrical progres sion, 55 to 1,800 r.p.m. in either direc tion. Changes are made in two series by sliding gears controlled by a singl rotating lever, a high and low series selective lever, and a back gear lever A direct reading dial indicates th speed engaged. All gears are of hea treated alloy steel, ground on the toot form, with integral keys. Anti-friction bearings are used largely throughou the drive from motor to cutter. Th spindle is of special alloy steel wit standardized end, hardened and ground The hole through is 21/32-in. diamete with No. 40 milling machine standar taper hole at the end. The spindle i mounted on anti-friction bearings.

The spindle head swivels in a verti cal plane and can be set at any angl to 90 deg. either side of zero. A locking plunger provides for exact vertica alignment of the spindle. A 3-in. axia movement is available in all position of the spindle head, movement being obtained by use of a handwheel which may be used on either side of the head

The table, including oil pans and channels, is 50½ x 10 in. Working sur face, 45 x 10 in., with three T-slots ⅝ in. wide. Feeds are all gear drive through alloy steel sliding gears mount ed in anti-friction bearings. An over load release is provided, and drive is automatically re-engaged when the overload is removed. Feeds are inde pendent of spindle speeds. There are 16 changes of feed in practically geo metrical progression from ½ to 18¼ in per minute, changes being made by a single rotating lever with direct read ing dial at the left side of the machine Fast travel is provided for longitudinal transverse, and vertical table move ments in either direction at a rate of 76 in. per minute. It is available at a times, obtained by pressing a switch



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A Molybdenum addition to cast iron has often proved the best way to get the most out of money spent to improve materials.

The selection of a gray cast iron with 0.75% Moly for 64-inch rubber mill drives is a typical example. The Moly iron is strong (a test showed 61,000 p.s.i.) and tough enough to stand severe service. Despite the necessary hardness, machining presents no difficulties. Thus full advantage is taken of the economy of cast iron, without sacrifice of performance capacity.

This is only one of the many cases in which Molybdenum iron has brought about a combination of economy with dependability. Investigation may show that you can apply it with advantage. Our technical book, "Molybdenum in Cast Iron," is free to interested production executives and engineers on request.

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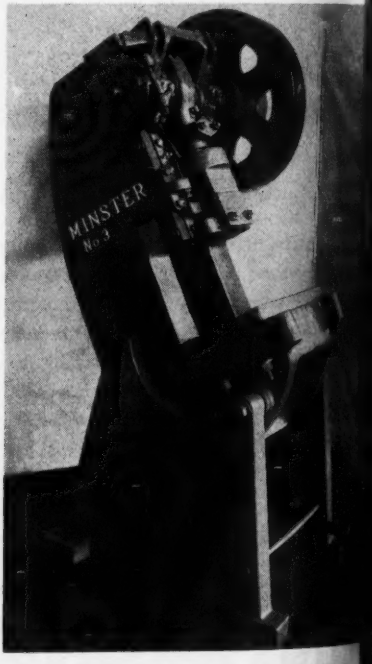
MOLY

button at the front of the knee. Wh the button is released, the table r sumes its original feed movement.

A coolant tank with a capacity of s gallons is cast in the base. All drivi mechanisms within the column are a tomatically lubricated by a plung pump, oil being filtered each time it circulated. Floor space required, 92 62½ in. Standard equipment includ the main driving motor, fast travel m tor, electrical controls and wirin No. 22F flanged vise, coolant drip ca four screws for attaching adapters spindle end, draw-in bolt, and set wrenches.

No. 3 Minster Open Back Inclinable Press

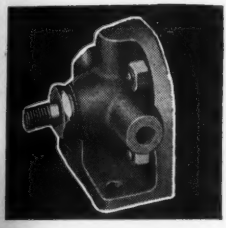
The Minster Machine Company, Mi ster, Ohio, offers a line of open bac inclinable presses in nine sizes, rangin in capacity from 12 to 113 tons. Th frames are of a high tensile strengt alloyed semi-steel cast constructio



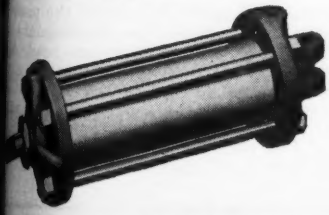
No. 3 Minster Open Back Inclinable Fr

AIR CUSHIONS

in *All* NOPAK Air Cylinders Eliminate Costly Metal-to-Metal Impact



NOPAK Cylinder Head with built-in, non-adjustable air cushion. Adjustable head can be furnished on one end only, if desired.



NOPAK Cushioned Air Cylinder with Pendulum Mounting. All standard mountings available.

. . . what's more, the new type, NOPAK Air Cylinders, with Non-adjustable, pneumatic cushion-stop, sell in the *same price range as non-cushioned cylinders!*

Now, instead of choosing between cushioned and non-cushioned cylinders, you choose between adjustable and non-adjustable cushion heads. Whichever you specify, you are sure of relief from noisy, wearing, piston-hammering, longer life for pistons, and cup-leathers, lower maintenance costs, and smoother, more efficient performance.

Both types of NOPAK Cushioned Air Cylinders have Special Composition Cup Packing and extra-wide piston bearing to protect cups from excessive wear and friction. Write for New Illustrated Bulletin.

GALLAND-HENNING MFG. CO.
2758 S. 31st STREET
MILWAUKEE • WIS.

NOPAK VALVES *and* CYLINDERS

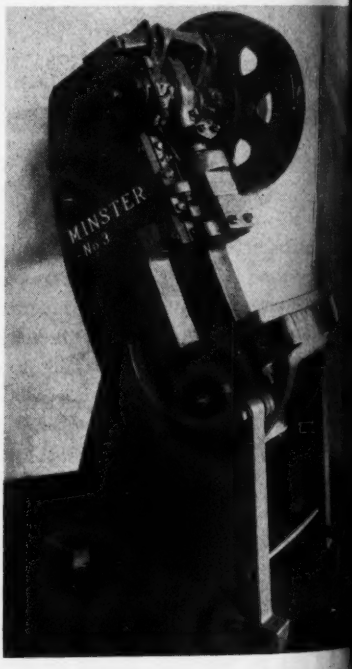
A 2436-1P

button at the front of the knee. W the button is released, the tabl sumes its original feed movement.

A coolant tank with a capacity o gallons is cast in the base. All driv mechanisms within the column an tomatically lubricated by a pi pump, oil being filtered each time i circulated. Floor space required, 62½ in. Standard equipment inclu the main driving motor, fast travel m tor, electrical controls and wi No. 22F flanged vise, coolant drip c four screws for attaching adapters spindle end, draw-in bolt, and set wrenches.

No. 3 Minster Open Back Inclinable Press

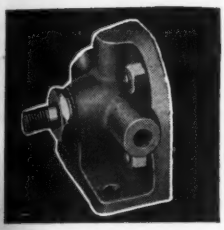
The Minster Machine Company, M ster, Ohio, offers a line of open ba inclinable presses in nine sizes, rang in capacity from 12 to 113 tons. T frames are of a high tensile streng alloyed semi-steel cast construct



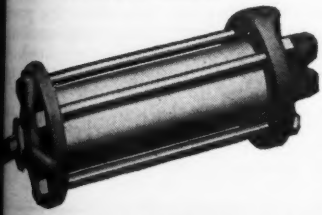
No. 3 Minster Open Back Inclinable P

AIR CUSHIONS

in *All* NOPAK Air Cylinders Eliminate Costly Metal-to-Metal Impact



NOPAK Cylinder Head with built-in, non-adjustable air cushion. Adjustable head can be furnished on one end only, if desired.



NOPAK Cushioned Air Cylinder with Pendulum Mounting. All standard mountings available.

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GALLAND-HENNING MFG. CO.
2758 S. 31st STREET
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NOPAK VALVES *and* CYLINDERS

A 2436-1P

The upper part of the frame is of box-type construction with 45 deg. overhanging crankshaft bearings.

True ring nickel bronze bushings are used for the crankshaft bearings and tapered anti-friction bearings are used on the drive shaft and clutch wheel.

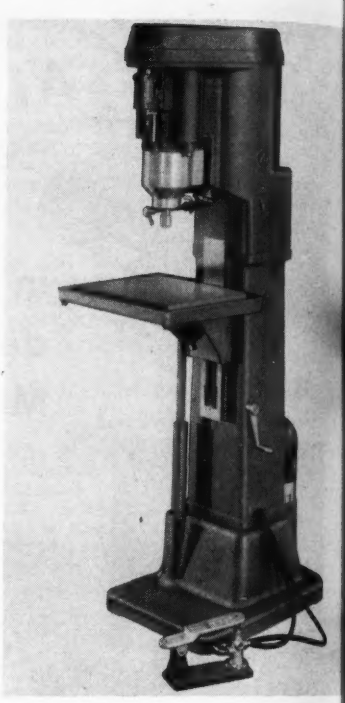
The slide and gib designs have been changed to incorporate longer ways, increased bearing surface, stronger slide and renewable nickel bronze ball and socket bushings in the slide. The brake on the positive clutch presses is designed to give long life, constant, uniform brake torque, and low operating temperature under extreme conditions. The brake shoe is a two-piece assembly, lined with four segments of oil-proof molded lining and finned to aid heat radiation.

The Multi-Engage Spline Clutch, having 10 to 22 points of engagement depending on the size, is standard equipment on these presses. Sizes No. 7, 8 and 9, in the geared type presses, can also be furnished with the Minster combination multiple disc friction clutch and brake.

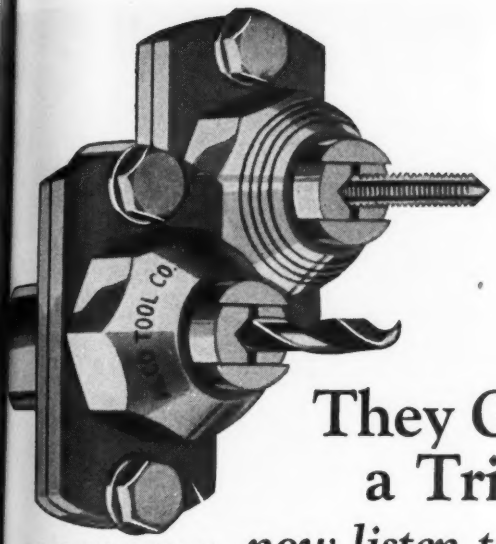
Haskins No. 3 Vertical Air-Controlled Tapping Machine

The R. G. Haskins Company, 619 S. California Ave., Chicago, Ill., announces the development of a tapping machine in which the operation is entirely air controlled for the purpose of securing the utmost in sensitivity and accuracy as well as speed of operation. This high speed precision tapper is to be known as the Haskins No. 3 Vertical Air-Controlled Tapping Machine. The motor is stationary, driving the tap head through a V-belt and multi-speed pulleys.

Compressed air controlled by an automatic air valve furnishes the pressu required for both the tapping and r versing strokes of the tap head. T automatic valve also controls the spe with which the tap is fed into and r versed out of the part. A foot ped unit enables the operator to start stop the tapping cycles, which are u der control of the automatic valve. T



Haskins No. 3 Vertical Air-Controlled Tapping Machine



They Gave Them a Trial---

PATENTS PENDING

now listen to their praises

re's what just a few enthusiastic users have to say about ALCO Drill cks and ALCO Tap Holders:

tomobile Manufacturer — "They are e best tools we have ever used for s class of work."

p Manufacturer—"Your tap holders rainly receive favorable comment m our manufacturing division."

trument Manufacturer—"A study was de of your tap holders for operation d are pleased to advise the result was ter product, less tap breakage and reased tap life."

Navy Yard—"Your drill chucks are so acceptable our operators dislike using previous type with bushing."

Scale Manufacturer—"We are constantly replacing our old type drill holders with ALCO drill chucks and our bushing worries are decreasing."

Watch Manufacturer—"The Accuracy of your drill chucks makes it possible to drill the small holes required in our industry."

y other users have written us with equal enthusiasm. These include many of e most important manufacturers in the country and abroad. We have yet to hear m one who has failed to effect economies, to "speed-up" his output and improve e quality of his work. Write today for detailed information and prices. Alco Tool mpany, Bridgeport, Connecticut, U.S.A.

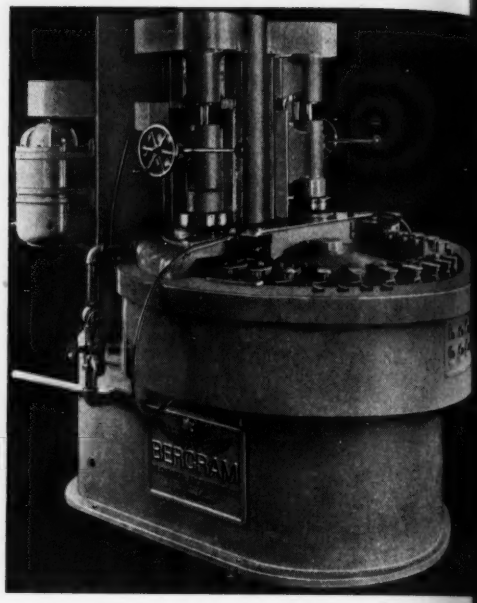
ALCO EFFICIENT TOOLS

machine will operate in continuous cycles as long as the air valve is held open. It can also be used intermittently by operating the foot pedal and then releasing it to produce one complete cycle.

The tapper lends itself to the feeding of parts into a simple holding fixture or a magazine fixture. It is also adapted to hopper feed, dial feed, or other specially designed fixtures.

Bergram Type SG Production Surface Grinding Machine

To meet a demand for greater capacity and improved production over the previously offered Type DG-1 Machine, the Type SG Production Surface Grinding Machine illustrated here has been designed by Bergram Mechanical Engineering Co., New Britain, Conn.



Bergram Type SG-1 Production Surface Grinding Mac

Automatically - operated fixtures of a number and type determined by the nature of the work are mounted on a revolving table which passes underneath the grinding wheels for stock removal in selected steps to a uniform height. The grinding spindles are driven by individual motors through variable speed devices and the table has an individual motor drive through a variable speed device, thus providing selection of proper work speed and wheel speeds.

Diamonds for dressing the wheels are adjustably mounted on the table. Feed of the wheels is provided for hand, automatic or push button control operation. Grinding wheels from 8 10 in. in diameter can be accommoda on this machine. The work table is in. in diameter. The machine shown arranged for wet grinding with wo holding fixtures which close during t grinding portion of one revolution, a open for ejecting or loading for the s mainder of the revolution.

The machines can be built to han workpieces of any height. For facil in setting up or changing over from o job to another, a complete assembly

fixtures is permanently mounted on ring as a unit which is bolted to table so that it can be readily remov and replaced by another unit. Spin column and base are of welded st construction, designed with inter ribbing to provide maximum rigidity a minimum deflection.

The machine is built in two siz Type SG-1 and Type SG-2. The T SG-1 Machine takes a grinding wh 8 x 3⅓ x 6-in. hole to operate at maximum of 2,700 r.p.m. and minim of 900 r.p.m. Motor required, 5 h.p. 1,800 r.p.m. Center of work table center of work when mounted in chuc 19-in. radius. Work table motor, 1 h 1,200 r.p.m. Work table speed, variab ⅓ to 1 r.p.m. Floor space requir 60 x 80 in. Weight, 8,000 pounds.

The SG-2 machine takes a grindi wheel 6 x 3 x 4-in. hole. Motor requir 3 h.p. at 1,800 r.p.m. Work table mot 3 h.p., 1,200 r.p.m. Work table spe ⅓ to 1 h.p. Floor space, 54 x 7 Weight, 6,500 pounds.

Monoset Tool Grinder

Tho Monoset Small Tool Grinder n being built by Chittenden Corporati 5005 Euclid Ave., Cleveland, Ohio, said to combine all of the mechani movements required to produce any sired geometrical tool or form wh can be produced by grinding. It is a said to make possible the quick a inexpensive production of many typ of tools by grinding from solid ha ened blanks without preliminary m chining, as well as the economical r conditioning of tools to extend the to life. Without attachments and with single chucking, the unit permits t completion of work usually requiri several set-ups and the use of as ma as five individual machines.

The Monoset Grinder generates sp rals, right or left hand, straight taper, 0 to 1⅓ turns per inch, male female radii, concentric or decentri with instant dial setting and with gears to change. When reconditioni spiral tools, if the spiral lead is know the dial is simply set at the chart graduations; if unknown, the lead ma be picked up by means of a work feel or finger. After spiral lead is foun the feeler is rotated away from th work and the work head spindle rot tion is then responsive to table mov ment. Rests are provided which ma it possible to grind uncentered stock even very small diameters. The fin

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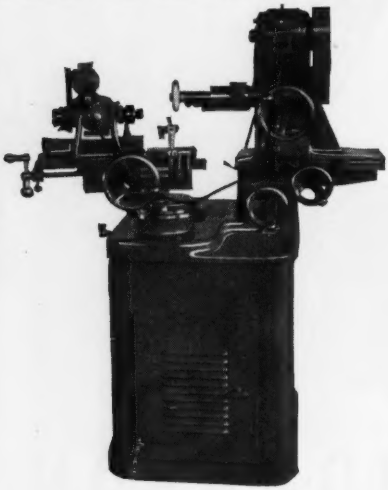
Sleeve BEARING HEADQUARTERS

590 S. MILL STREET · NEW CASTLE, PA.

diameter, any desired amount of lip clearance, and face are ground at a single setting.



Monoset Tool Grinder

All spindles of the Monoset Tool Grinder are of heat treated high te alloy steel and are mounted in su precision ball bearings, constant lu and fully sealed. All slides are shrou and all operating mechanism is fu housed. Castings used are of Mecha metal. The base is of welded steel w ventilated door and tool shelves. B anced motors are used, of sealed l bearing construction. Collets are highest grade tungsten alloy ste heat treated to assure accuracy a durability. Lubrication is constant a uniform.

The turn table can be rotated 220 de in a horizontal plane. The work he tilts 45 deg. above or below center. T work can be fed to the wheel or t wheel to the work as desired. Outs and inside diameters can be ground a single setting. Main spindle can centered in either vertical or horizon plane instantly. The base is 25 x 28 and the floor space required is 5 x 6 Height from floor to center of wo head spindle, 45 in. Spindle mot ⅓ h.p., 110 volt, 60 cycle, A.C., 1,7 r.p.m. Work head motor, 1/15 h.p., u versal type; speed, 200 r.p.m. Max mum swing over carriage, 9 in. Offs slide movement, 2⅛ in. either side

with Cushman **PRECISION** Chucking Methods

for **ACCURACY** and **SPEED** in Machining Vital Aircraft Parts

If there is one place in a plane where slight inaccuracy . . a thousandth of unwanted play; a fraction of unbalance . . . can cause all kinds of serious trouble, that place is in the propeller.

The picture above shows the set-up for machining the vital hub surfaces of controllable pitch propellers in America's most famous propeller manufacturing plant. The chuck is a standard Cushman Precision 4-jaw combination chuck . . . a chuck that, because of exceptionally fine design and the precision methods used throughout its manufacture, will hold initial tested centering accuracy throughout long daily production line service.

If you would be familiar with the preferred precision chucking practices of the World's leading metal working industries, send for and study the Cushman Catalog . . . 104 pages of listings, blue prints and engineering data covering both standard and new types of chucks.

The Cushman Chuck Company, Hartford, Conn.

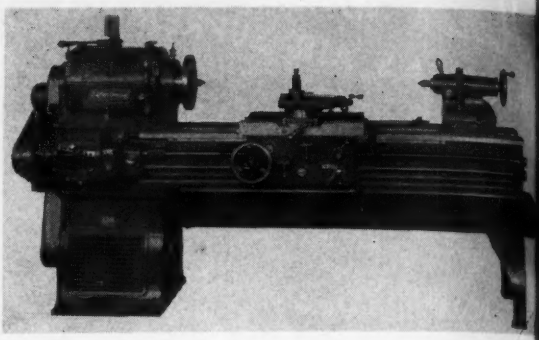
A world standard for **PRECISION**

CHUCKING ENGINEERS *Since 1862*

center. Transverse slide movement, 6 in. Longitudinal, 7 in. Main spindle speed, 8,000 r.p.m. High spindle speed, 35,000 r.p.m. Approximate shipping weight, crated, 1,000 pounds.

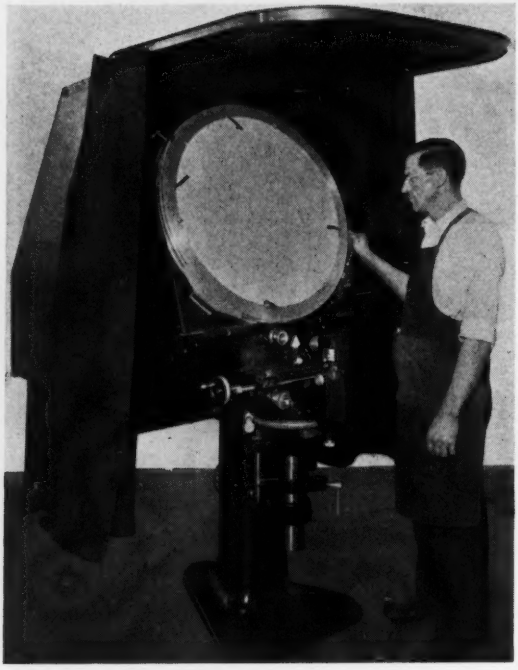
16-In. Rockford Economy Lathe With Hollow Spindle Headstock

To meet the requirements of a customer, Rockford Machine Tool Company, Rockford, Ill., recently equipped a standard 16-in. Rockford Economy Lathe with the headstock shown in the illustration. The feature of the headstock is a hollow spindle having a 4-in. bore. Following the standard design of the Rockford Geared Head Economy Lathe, this hollow spindle headstock has full Timken bearings. The carriage of the lathe is equipped with drop lever control to longitudinal and cross feeds.



16-In. Rockford Economy Lathe with Hollow Spindle Headst

With the exception of a slight i crease in swing and a slight decrea in maximum spindle speed, the speci cations of this machine are essentia the same as the standard 16-in. Eco omy Lathe. The hollow spindle lat has speeds of from 15 to 296 r.p.m. wi drive pulley speed of 385 r.p.m. T lathe is particularly adapted to lig hollow spindle work such as operatio on tubing where cuts are relative light and diameters relatively large.



J&L Comparator and Measuring Machine

J&L Comparator and Measuring Machine

The Jones & Lamson Machine Company, Springfield, Vt., announces a new model of the J&L Comparator and Measuring Machine which has a 30-in. diameter screen, thus permitting the optical inspection of large objects at suitable magnification. Typical parts for which the machine is suited are large form tools, cutters, hobs, t and gages, as well as p ucts. The following lenses be furnished: 20X lens wh will project a 1½-in. area ject; 30X lens which will p ject a 1-in. area object; lens which will project a 4.6 area object, and 100X which will project a 0.3 area object.

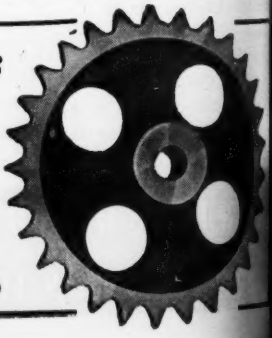
The periphery of the 35 diameter ring, which suppo the screen, is graduated one-half degrees, reading w the vernier to one minute arc. This machine will acco modate objects 8 in. in dia ter by 21 in. long and has p visions for measuring 4 in. the co-ordinates.

The machine is furnish with any one of three types table; plain table without l eral adjustment, table with in. lateral travel, and ta with 8-in. lateral travel. T table may be swiveled to po tion the helix of hobs and t normal to the axis of the le system.

Lead measurements on t tables with lateral travel m be accomplished by the use the micrometer attached to t table, by spacing blocks or e measuring bars. An attachment can supplied for measuring by reflecti those surfaces which cannot be p jected.

"High Speed" Four-Speed Drilling Machine

The High Speed Hammer Co., Inc Rochester, N. Y., who have manufa



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flecting in every detail the many advantages of Buck- exacting metallurgical standards and skillful manu- ure, Buckeye Bearings will give you a maximum of factory service. Customers say they are a premium duct—yet they sell at the standard price. That's why dreds of manufacturers specify—and insist on getting— keye Bushings. • Send for the Buckeye Catalogs. They 787 standard sizes of ready-to-use bushings—154 sizes ored and solid bars, ideal for maintenance work—and sizes of electric motor bearings. Then, like other com- ies, you too can order Buckeye Bushings—from stock om the 18 warehouses located at strategic points from st-to-coast. No obligation. Send for the catalogs today.

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Catalog 137 lists 787 sizes of ready-to-use industrial bushings and 154 sizes of cored and solid bars.
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Sent on request. Write today.

No order is too big or too small for Buckeye

Write Cleveland direct on blue print and specification requirements.

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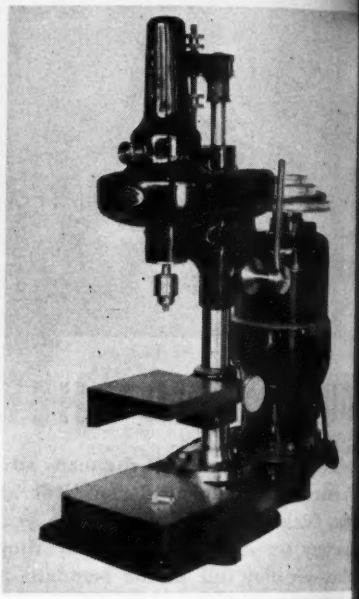
RASS AND MANUFACTURING COMPANY

BRONZESMITHS SINCE 1900

HAWTHORNE AVE. CLEVELAND, OHIO

tured the two and three-speed Mod R-53 Precision Drilling Machine for number of years, are now adding four-speed machine to their line. T speeds of the machine are 750, 1,5 3,000 and 6,000 r.p.m. The range of t machine is from No. 80 to ¼-in. dri Holes of 0.010-in. diameter have be successfully drilled with it.

Because of an increasing demand f a sensitive drilling machine with t

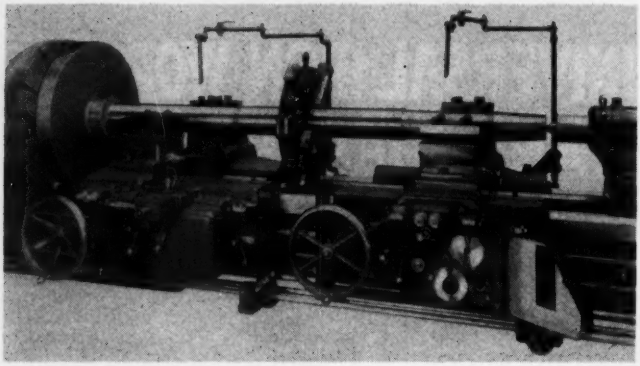


"High Speed" Four-Speed Drilling Machine

proper speed for tool steels, stainles and other tough alloy steels, the spi dle speed of 750 r.p.m. was added t the other three speeds. This speed i also useful in certain drilling operation in slate and other non-metallic ma terials.

"American" Geared Taper Turning Mechanism

The geared taper turning mechanis recently developed by The Americ Tool Works Company, Cincinnati, Ohi for application to Super-Productiv lathes is designed to turn tapers withi a moderate range of diameters on an length of work up to the full cente



"American" Lathe with Geared Taper Turning Mechanism

distance capacity of the lathe.

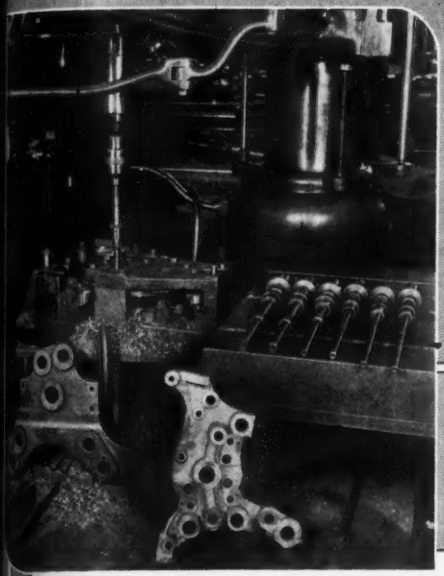
With the geared taper turning mechanism, the taper on the work is produced by the simultaneous functioning of the longitudinal and the cross feeding mechanisms, the various degrees or rates of taper being determined by the relation of the length of carriage travel to the rate of cross feed of the tool slide.

The cross feed rate is determined by a series of ch gears mounte a suitable q rant in the ap The change g are enclosed h inged co which, w swung open, ables easy ac to the gear m anism. The t turning mec nism is actu through the f rod and the re lar apron gear

An outstand feature of t apron is its s plicity, both f the standpoint of operation and control of the mechanism for chan over from straight to taper turnin vice versa. This is accomplished by plunger lever shown at the left fr side of the carriage bridge.

Suitable pinions on the cross f screws form the means of cross fe ing for either front or rear tur rests, separately or simultaneously power or hand feed. Both rests ca

DAVIS BORING TOOLS



are Very **ECONOMICAL** *and* **EFFICIENT"** *Says*

HARRIS, SEYBOLD & POTTER
CLEVELAND, OHIO

Davis "L" type Micrometer Expansion type cutters on bars have proved very economical and efficient in this set-up. All bars are used in a quick-change chuck, and are piloted in a fixture both above and below the work.

The universal application of Davis "L" type bars is clearly illustrated by the many different size holes which are bored in these parts, all of which are rough and finish bored to size with Davis tools.

Send us prints of *your* special or unusual work and, without obligation, we will submit you a helpful, specific recommendation.

DAVIS BORING TOOL DIVISION
Larkin Packer Company, Inc., St. Louis, U. S. A.

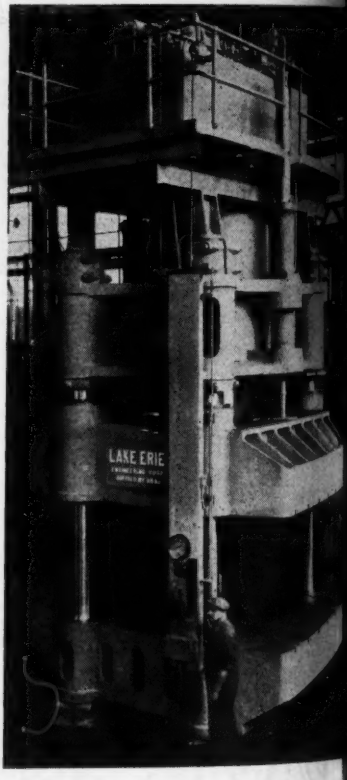
DAVIS BORING TOOLS

operated separately or simultaneo for either straight or taper turn Convenient hand adjusting means provided for either tool slide.

When turning taper work, the cut is done from the small end at the stock to the larger diameter at head end, the tools feeding away f the work axis. If the direction of riage longitudinal feed is reversed, tools will feed in toward the w center.

Lake Erie 2,500-Ton Hydrau Press

The 2,500-ton capacity Lake Erie draulic Press illustrated herewith is of 14 built by the Lake Erie Engin ing Corporation, Buffalo, N. Y.,



Lake Erie 2,500-Ton Hydraulic Pres

QUALITY IS MORE THAN SKIN DEEP

SO WE LOOK DEEP UNDER THE SURFACE

. . . OF OUR SPECIAL PARKALOY ROD

With the finest of metallographic equipment at hand, the Parker-Kalon Laboratory can look right into this special [illegible] nickel alloy. Make sure that grain size, carbon content and structure are 100 percent correct.

. . . . . OF OUR FINISHED SOCKET SCREWS There's no guessing about their properties. The photomicrograph magnifies grain size and other structural characteristics to 1000 diameters. Tells whether product meets higher standards set by Parker-Kalon.

Example of the QUALITY-CONTROL that leads critical buyers to demand PARKER-KALON

Visit the $250,000 Parker-Kalon Laboratory and you'll understand how Parker-Kalon produced Socket Screws that set a new standard of quality. And why every Parker-Kalon Cold-forged Socket Screw possesses ALL essential qualities.

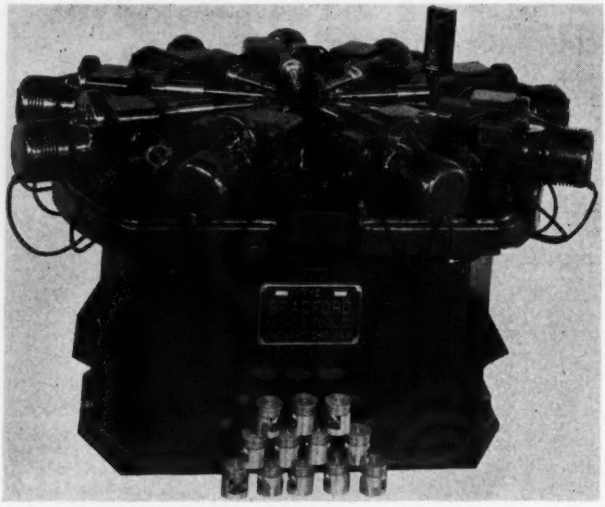
Unequalled in the screw industry, this laboratory with its Quality-Control facilities guarantees perfection. Get free samples—put them to any test.

PARKER-KALON CORP., 198M Varick St., New York

PARKER-KALON Cold-Forged **SOCKET SCREWS**

forming duralumin sections of airplane wings, pontoons, and fuselage parts. The press illustrated weighs 392,000 lbs. and required six freight cars for transportation.

The ram is 42-in. diameter and platens are 150 x 89 in. The press is a self-contained unit with electrically driven pumps mounted on its upper deck.



Bradford Nine-Unit Drilling Machine

Bradford Nine-Unit Drilling Machine

The Bradford Machine Tool Co., 657 Evans St., Cincinnati, Ohio, has developed a machine for the drilling of closely spaced small holes such as the "smoke" holes in automotive pistons which the machine in the illustration is designed to handle. The pistons be drilled by this machine have 18 ho so spaced that it is impossible to d them all simultaneously, therefore machine is devised to drill 9 holes, tomatically index the piston 180 d and then drill the remaining 9 holes.

The machine consists of a wel steel base which also acts as the collector and cle out. On top of base is supported cast iron table w radial T-slots which nine Bradf No. 0 automatic un are fastened, th method of mounti permitting futu changes in the loc tion of the smo holes. The pot-ty holding fixture placed on a specia developed, electric ly operated ind table actuated a controlled entirely solenoids and lim switches. The ma ter control of t machine is throu a push button st tion at the operato position in conju tion with a contr panel built into t machine at t rear of the bas Synchronization of all movements is e sured by electrical interlocks on all ci cuits, preventing any possibility of i terference between the various fun tions of the machine either throu breaking of some part of the mec anism or carelessness in the handli of the push button by the operator.

The machine is of anti-friction co

JOHANSSON SET No. 1

(Accurate to ±.000008 inch)

New Low Price

ONLY $285

The 81 blocks of this set in combination form 120,000 gages, in steps of .0001 inch, from minimum size .200 inch to more than 12 inches. These blocks are also sold separately.

Johansson Blocks are available accurate to within ±.000008 inch, ±.000004 inch, or ±.000002 inch.

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FORD MOTOR COMPANY

JOHANSSON DIVISION — *Dept.* G, DEARBORN, MICHIGAN

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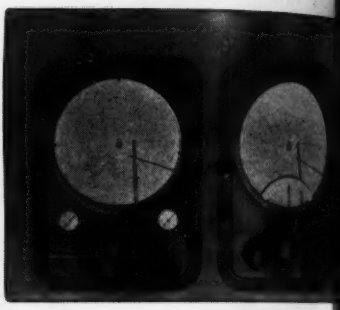
struction throughout, every bearing being either ball or roller type running in oil. Each of the nine automatic units is powered by a built-in ½ h.p. 3,450 r.p.m. ball bearing fully enclosed motor. The power circuits are 440 volts, while the control circuits are provided with 110 volts through a heavy duty transformer built into the control panel. All motors, and also the indexing solenoids, are provided with individual thermal protection against overload and undervoltage.

Spindle speeds are 5,100 r.p.m., and indexing time for the 180 deg. index is less than one-half second. The machine finishes 600 pistons per hour, which is equivalent to 10,800 drilled holes. This extremely high speed of operation and synchronization required the timing of some of the synchronizing cycles to within one-tenth of a second which is said by the manufacturer to be impossible with any other method of control except electrical.

Bristol Flow Ratio Controller

The rate of flow of one fluid in definite ratio to the flow of a second fluid. automatically controlled, is accomplished by means of a Flow Ratio Contro developed by The Bristol Compa Waterbury, Conn. One of the featu of the controller is an arrangem

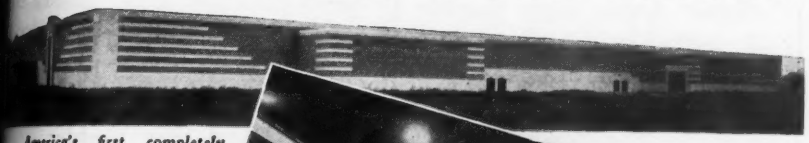


Bristol Flow Ratio Controller

which permits changing the ratio any time by simply turning a knob the outside of the case.

Thus, a 5:1 ratio between the flow air and fuel gas, a 4:1 ratio betw the flow of natural gas and artifi gas, a definite ratio between two dif ent kinds of gasses in a furnace, o definite ratio between the lean oil

Simonds...the World's Most Modern Saw Plant...Specifies AAF Dust Control



America's first completely AIR conditioned windowless factory—equipped with AAF dust control.

28 Type D Roto-Clones for dust control on grinding equipment and 2 Type W Roto-Clones for servicing sand blast cabinets.

More conscious than ever of the need for carefully engineered dust-control and air-filtration equipment, industry is finding a solution of its dust problems in standard AAF equipment—*engineered* to meet the requirements of specific industrial applications.

The American Air Filter Company's Engineering Department is available to *you*—without obligation—to study your Dust Control problem and submit recommendations. Address Dept. 123.

AMERICAN AIR FILTER CO., INC.
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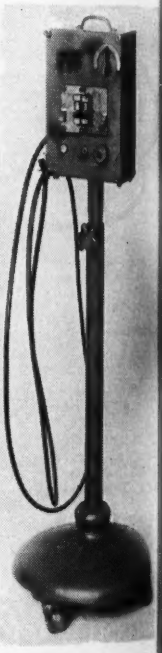
AIR FILTRATION AAF DUST CONTROL

wet gas entering an absorber, are some of the useful applications of these instruments.

As shown in the illustration, the Bristol Flow Ratio Controller consists of two instruments—one a standard Flow Recorder and the other a standard Flow Recorder Controller. The rate of flow is measured and recorded by one instrument, which also sets the control point on the second. The latter then records and controls the flow proportionately to the first, depending upon the ratio selected.

Laidlaw Model 110 Jr. Portable Band Saw Welder

Illustrated here is a portable band saw blade welder which is designed to join together the ends of a band saw blade by resistance welding. The machine, product of William Laidlaw, Inc., Belmont, N. Y., is available in two sizes, known respectively as the Junior and Senior models. The Junior model will handle blades from 0.01 to 0.05 in. in thickness and from ⅛ to ½ in. in width. The Senior model will take the same thicknesses and has capacity in width from ¼ to 1 inch.



Laidlaw Model 110 Jr. Portable Band Saw Welder

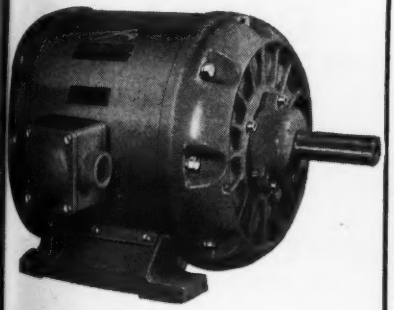
The transformer with which the machine is equipped can be supplied for 110 or 220 volts, 60 cycle, single phase, A.C. Both units are fitted with motor-driven grinding wheels to remove flash after the weld has been completed.

In the center of the machine panel is a pair of dies into which the two ends of the saw blade are inserted and clamped in position. In the upper right-

...nd corner is a pointer which is turn-...d to the left for the spacing for the ...eld and then to the right for tension. ...e Push button is located in the lower ...t-hand corner of the panel and is ...ssed and held until the ends have ...en brought up to heat and the weld ...mpleted. The pointer is then turned ... "anneal" position and the blade is ...clamped with the weld in the center ...f the space between the two dies. The ...sh button is used intermittently until ...e blades become a dull red color. The ...inding wheel is started and stopped ...y means of a small toggle switch pro-...ded for this purpose.

Louis Allis D.C. Explosion-Proof Motor

The Louis Allis Co., Milwaukee, Wis., ...s placed on the market a D.C. Explo-...n-Proof Motor designed especially for ...e in gaseous mines. In this motor ...e incorporated 18 separate and dis-...ct improved features, one of which ... its small, compact overall dimen-...ns, making the motor interchange-...le with A.C. and D.C. NEMA frame



Louis Allis D.C. Explosion-Proof Motor

...ns with reference to NEMA dimen-...ns D and shaft sizes. The unusually ...w overall height which makes it par-...cularly adaptable for low overhead ...ines is said to be especially important. Because of its rugged, heavily rein-...rced cast-iron and steel construction, ...mooth, streamline shape and double ...rotected insulation, the D.C. Explosion-...roof Motor is said to be protected from ...very angle to assure a long life of ...dependable, trouble-free performance

on the toughest jobs.

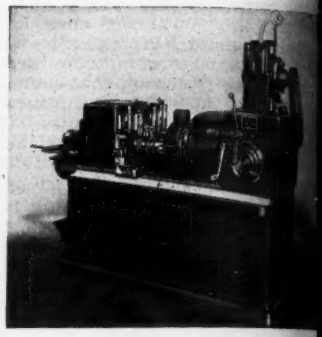
According to the manufacturer, the motor will deliver a constant, smooth flow of absolutely dependable power under the most severe mine operating conditions, and do it safely in atmospheres containing explosive dust or gases.

The Louis Allis D.C. Explosion-Proof Motor is available in a wide range of both electrical and mechanical modifications.

Billings Di-Matic Bar Stock Automatic Machine

To meet the demand for a fully automatic machine of simple design but suited to the rapid production of less complex parts, yet with speed and accuracy necessary in competitive production, the Billings Di-Matic, illustrated herewith, has been brought out by The Billings & Spencer Company, Hartford, Conn. The machine is said to be easy to tool up and economical to operate on short runs.

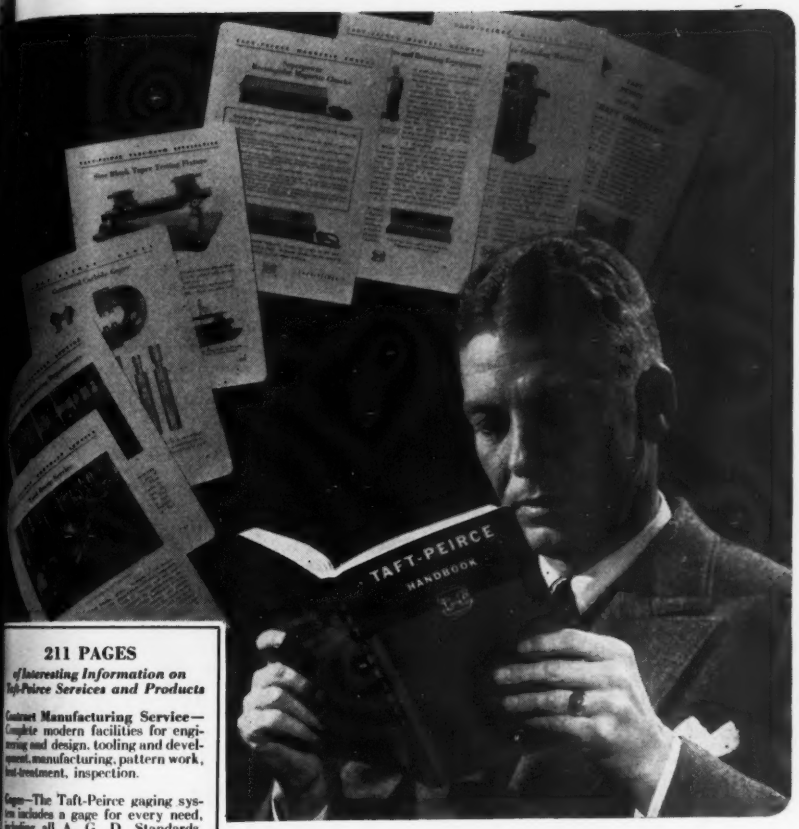
The machine has two non-indexing spindles of standard design immovably set in a heavy, rigid frame, with opposed adjustable taper roller in f and cylindrical roller bearings in This construction is said to allow



Billings Di-Matic Bar Stock Automatic chine shown in index position with high arm in the high speed position.

heretofore prohibitive to indexing chines.

The cross slide carries a form for each spindle, operated by a type direct-acting cam. The bed



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Here's the 1939 edition of the Taft-Peirce Handbook . . . a valued right-hand aid to production executives, purchasing agents, shop foremen, master machinists. It gives complete illustrated information on the standard products and special services available through Taft-Peirce. This new printing also describes several important new Taft-Peirce products, ranging from gages to machine tools . . notably a new surface grinding machine.

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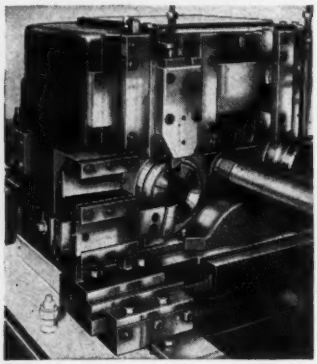
the cross slide is cast integrally with the headstock, making an unusually solid foundation for the forming slide.



Billings Di-Matic with collet unloaded in front spindle, showing form tool in cutting position on cross slide and cut-off tool on upper independent cut-off slide.

The cut-off tools can be removed from the slide without disturbing the set-up. The cross slide cam action is of unusual design, the single cam rev ing between two rollers and thus taining smooth, direct action with backlash.

The turret, which has two tool tions, is a simple, cylindrical d carried in a massive housing that sl on the bed of the machine in harde and ground steel ways. The turre operated directly from the cams on drum above the slide. Fitted over main drive shaft is a torque tube wi takes the place of the conventional c shaft and controls the feed mechani The torque tube has a powerful pla tary drive which assures smooth act The main drive mechanism is enclo in a sealed gear box and runs i bath of oil. The torque tube car which is threaded, carries the s stop.

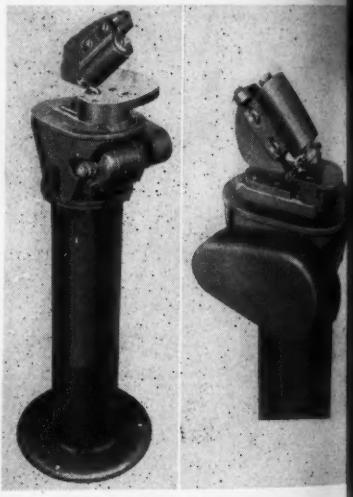
The cross slide bed and headst are cast in one piece, forming an usually solid construction and, in c junction with the cam and rigid sp dles, permits a new conception of curacy in forming. Collets and push are of conventional type, cam spring fed, with their action adap to feed through one spindle at a ti alternately, during dwell in index

Spindle speeds and feeds are changed by the use of gears of the "pick off" type. The pulley shaft runs at a constant speed of 900 r.p.m. and spindle speeds up to 1,800 r.p.m. are available through change gears. The turret is indexed to bring the various tools to the work by a modified Geneva motion. An indexing arm swinging on a bracket over the cam drum and actuated by a cam inside the drum engages the lugs on the turret indexing disc. The turret swings 180 deg. As it reaches 90 deg. it dwells, while the collet opens, stock is fed through to stock stop, and the collet closes, indexing is completed, turret is locked in position, and slide carries it back to the work. T positions in the turret are made for holders 2 in. in diameter. Tool hold are held securely in place by pi bolts. Provision is made to force c ant through turret tools under pr sure when required.

The spindle capacity is 1½ in. ro stock; feed length, 5 in. maxim Motor recommended, 5 h.p. Floor sp required, 8 ft. 3 in. without stock s port. Height, 4 ft. Weight, 6,000 pou

"Quickwork" Combination Throatless Shear and Flanger

The "Quickwork" Combination Thro less Shear and Flanger illustrated he with, a compact, versatile unit that



"Quickwork" Combination Throatless She and Flanger

handle a wide range of sheet metal fa rication, has been placed on the mark by The Quickwork Company, 400 W Madison St., Chicago, Ill. It is of str plified unit type design for maximu utility—as a shear, as a flanger, or both, as bench-type or pedestal-mount machine, for production shop work o as portable equipment out on the jo As a shear, it will handle all straig

and irregular cutting, including full circles and curves, both concave and convex. Material of any width or length can be cut. The smooth, even action of the self-feeding rotary cutters makes it easy to follow the most intricate layouts.

A simple, quick change of heads converts the machine into a flanger which is equally simple and easy to operate. The shoulders of the flanging rolls act as a guide for the depth of flange. Attachments and rolls can also be furnished for U-ing, wiring, special flanging and forming.

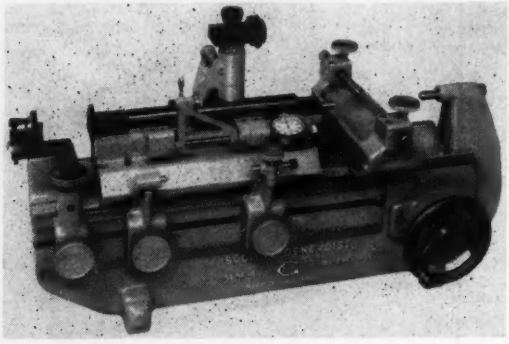
The machine as furnished is arranged for two cutting and flanging speeds. It is ball bearing equipped throughout. Cutter and roll shafts have lifetime ball bearings and all of the drive mechanism runs in a bath of oil, thus reducing the lubrication job to a minimum.

Societe Genevoise Type MUL-250 Shop Gage Measuring Machine

On behalf of the Societe Genevoise D'Instruments de Physique, Triplex Machine Tool Corp., 125 Barclay St., New York, N. Y., is announcing a high precision measuring machine for industrial shop use to be known as the Type MUL-250. Embodied in this measuring machine are the important features of the highly accurate machines used in various bureaus of standards both in this country and throughout the world. The Type MUL-250 Measuring Machine makes possible the direct measurement, inspection, and checking of all production gages to a degree of accuracy that is generally possible only in the laboratory.

Mounted on a bed of cast iron of extreme hardness is a measuring carriage which supports a divided scale measuring anvil for external measurements, dual flat feeler for internal measurements, and feeler with dial gage for measuring pitch. Guided on precision rollers which bear on the V and flat guides of the bed, the carriage is traversed by handwheel. Its displacement is rated to 0.050 in. or 1 mm. on the auxiliary scale. It is accurately positioned by means of a slow motion knob, both controls being constantly engaged. All measurements are effected under constant measuring pressure of less than one pound. The standard scale is

fitted with measuring anvils to carry out the various testing operations and moves under a micrometer microscope to permit direct readings to 0.00005 in. or 0.001 mm. Fractions of these values are easily estimated. A goniometric microscope increases the field of application of the machine; it is suited for the measurement of angles and is particularly useful for the examination of thread profiles.



Societe Genevoise Type MUL-250 Shop Gage Measuring Machine

The standard scale is graduated in twentieths of an inch or in millimeters. Its coefficient of thermal expansion is consistent with the value agreed to by I. S. A. and all national standardizing bodies so that corrections for room temperature are unnecessary. The glass which protects the scale is optically flat and has no influence on the precision of the readings. A calibration chart of the scale established to 0.00001 in. is supplied with each machine. The micrometer microscope which sights the standard scale has a magnifying power of 50X. The division of the eyepiece reads to 0.005 in. while readings to 0.0000 can be made on the divided drum, fo tions of these values being easily e mated. The illumination device co prises a 4-volt lamp with green filter

Cylindrical parts are measured tween the carriage anvil and the sta bed anvil, both of which are faced w tungsten carbide and impervious wear. The floating transv sal support allows for measurement between cent of parts up to 4-in. diame Cylindrical pieces which c not be held between cent are measured in a measur table mounted on the bed w in place of the transver support. This table also ser for the measurement of pi with parallel faces. Its pla is supported at three po and can be levelled by me of adjusting screws. Exter screw threads are measu on the transversal center s port, the effective diameter ing obtained by the aid calibrated wires which s serve for checking the ru of taps. The core diam is measured by means of a se prisms which can be used for all pitc larger than 25 T.P.I. Screw thr gages, taps, screws, and similar w are held between centers on supp which are mounted on scraped ways the front of the bed.

The goniometric microscope allows the measurement of angles on thr and for similar work. Mounted on cr slides with measuring screws and ro ing drums, it can be used in inspect threads for the measurement of r and fillets or flats. Inclined at 20 to facilitate the observation, the g ometer head comprises two superp posed glass reticles, each provided w

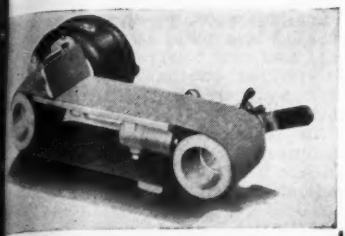
a dotted diametral line. One is fixed, while the other rotates, together with a glass circle illuminated from below and graduated in degrees. Angles are read to one minute of arc on the scale of the eyepiece of a small auxiliary reading microscope. The goniometer has fixed focusing adjusted on the plane of the centers of the work-holding supports. It can be tilted to the main helix angle of the thread to ensure maximum sharpness of the profile image. Field illumination is furnished by a small collimator with 4-volt lamp fixed to a tiltable plate supporting the microscope so as to keep the light beam centered.

The maximum measuring range between centers is 8 in. and maximum diameter accommodated, 4 in. Pitch can be checked on a maximum length of 10 in. and maximum diameter of 3¼ in. Length of bed, 32¾ in. Width of machine, 16¼ in. Total height, 18½ in. Weight, net, with normal equipment, 216 lbs. Normal equipment includes machine with standard scale, micrometer microscope with illumination device, transversal support for measurement of diameters, two center supports, and one feeler-holding frame with dial gage for measurement of pitch, one flat adjustable support for snap gages, one b in transformer 110-125-220/4 volts. A one reference ring 1½ in. with cali tion certificate, one 0.2 in. gage bl one slip feeler for measurement rings, five feelers for measurement pitch, and three supporting blocks.

Model QR "Rockwell" Hardn Tester and Model QS "Rockwe Superficial Hardness Teste

For jobs where hardness testing quirements call for 100 per cent duction testing of parts made in la quantities, or for testing a large centage of the products, the Model "Rockwell" Hardness Tester and Model QS "Rockwell" Superficial Ha ness Tester, recently placed on the m ket by Wilson Mechanical Instrum Co., Inc., Concord Ave. and 149rd New York, N. Y., are said to many advantages without any los accuracy in testing.

These motorized models are made an 8-in. vertical capacity. The readi obtained are identical with reading



An Inexpensive

NEW ABRASIVE BAND GRINDER..

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The Hormel-M Grinder is sturdily built with a supporting leg under the grinding table to eliminate vibration and tipping due to pressure on the belt. Ball bearing throughout. Equipped with ALEMITE LUBRICATION complete with grease gun.

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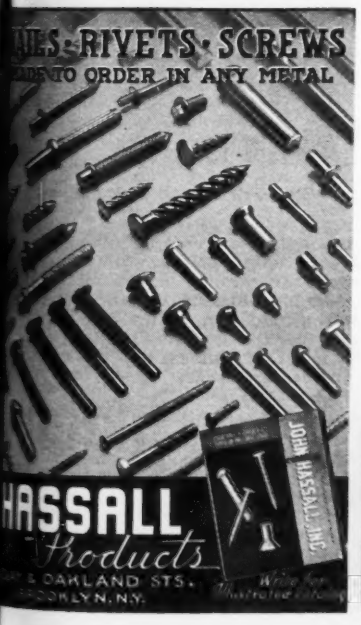

Forget rust! Water or dampness can't affect the new Lufkin Wizard Junior, All Stainless Tape-Rule. Both blade and case are made of genuine stainless steel. It's ideal for work in damp places and around salt water.

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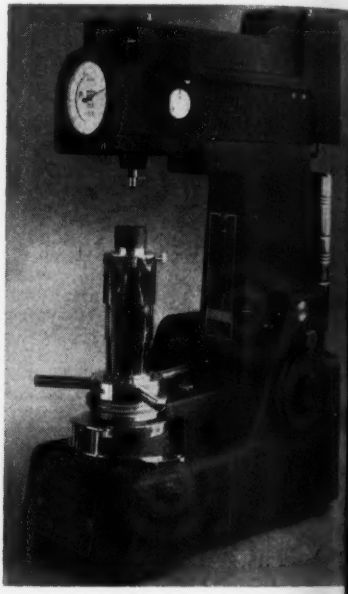
tained on "Rockwell" hand-operat machines and the speed has been creased to a point consistent with ac rate and reliable results. Specificatio determined on the hand-operated mo els may therefore be met on these m torized testers.

An extensive study of producti hardness testing with light loads an as are used on the "Rockwell" tes indicates conclusively that speeding



"Rockwell" Model Q Hardness Tester

the operation of the machine does necessarily speed up in direct propo tion the number of pieces that can tested. Efficient handling of the w oftentimes can do more to increase number of pieces tested than a amount of quickening the operation the tester itself.

The design of the motorized "Ro well" testers is such that no time wasted after the material is inser in the machine and no time is l through idle cycles of the machi when the specimen must be placed position with care. Readings are ab lutely independent of variations thickness of pieces tested.

There are not many applicati where motorized equipment will be

decided advantage to the user, but for such applications the Q Model "Rockwell" and "Rockwell" Superficial Hardness Testers are said to give genuine "Rockwell" numbers on a machine which conforms to the high standards of precision and accuracy that are built into the hand-operated models. With the Q Model products can be tested to the same hardness limits as previously. It is not necessary to sacrifice the quality of inspection for the sake of making more tests per day.

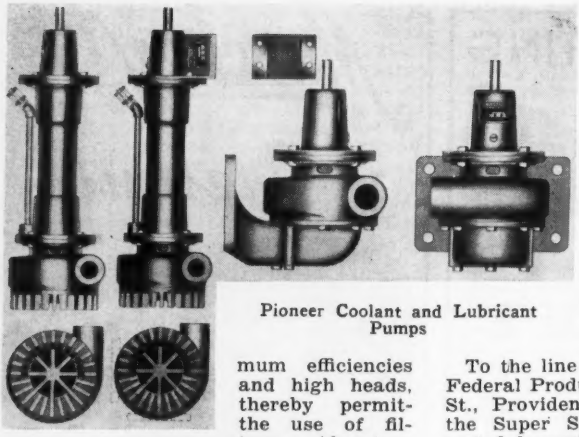
Pioneer Coolant and Lubricant Pumps

An additional series of coolant and lubricant pumps has been announced by the Pioneer Engineering & Manufacturing Company, 31 Melbourne Ave., Detroit, Mich. The units are designed especially to be used in conjunction with machine tools or auxiliary tanks where the unit must be driven with a flat or V-belt, chain, gear, or flexible coupling, or where it is impossible or impractical to mount motorized models. They are said to be particularly desirable for use on export or foreign shipments where the electrical characte tics usually have a tendency to a the motor speed and therefore the livery of the unit. All parts are in changeable and the entire assembl may be used in place of other stand types regularly furnished by this co pany.

The Model FV (Foreign Vertical) a the Model FB-V (Foreign Bracket V tical) are designed in such a way as be submerged directly into the ta or reservoir and to be attached to side of the tank or machine as quired. The FB-V may be suspen by the foot bracket attached to pump, whereas the Model F-V wo be mounted with the conventio brackets and flanges available for with all other types of Pioneer verti pumps.

The Model F-VB is built for mou ing on the side of a coolant tank machine pedestal for close coupled stallation. No auxiliary inlet piping required.

All of the units are built in capa ties up to 175 g.p.m. and pressures to 53 lbs. per square inch. The units a of the open impeller type with partic lar attention being paid to obtain ma



Pioneer Coolant and Lubricant Pumps

mum efficiencies and high heads, thereby permitthe use of filters. Abrasives or other foreign matter in suspension in the liquid being pumped will not damage or impair their efficiency or life.

A special mechanical seal is used in all Pioneer pumps, so designed as to eliminate shaft friction and the need for repacking. This also eliminates the necessity for maintaining pump locations in relation to liquid level, particularly in the F-V model. The pumps operate at motor speed and otherwise, and require no relief or by-pass valves in the delivery line to protect the pump or motor when the coolant supply is throttled.

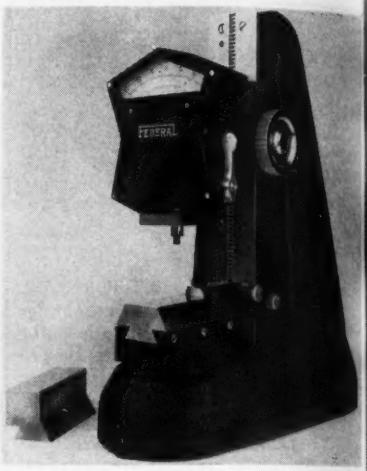
Federal Super Sensitive Comparator

To the line of dial indicators made by Federal Products Corporation, 1144 Eddy St., Providence, R. I., has been added the Super Sensitive Comparator illustrated herewith. The indicator on this comparator is especially designed for fine sensitivity and repetition qualities. The contact point spindle is supported by a spring bellows which eliminates friction on the spindle; thus internal friction and inertia have been reduced to the minimum.

The lever at the side of the indicator

controls the fine adjustment of the contact point after the indicator has been brought to approximate position on the vertical side and clamped. The frame is designed for maximum rigidity. The instrument is exceptionally simple and practical for checking other instruments, gages, and any work which requires a high degree of fidelity.

The indicator is graduated in 0.0001 in. and the total range is 0.003 in. The dial shows plus or minus 0.0015 in. The maximum height from top of anvil clamp block to contact point is 4.488 in. and the depth from center of contact point to vertical slide is 2-31/64 in. The contact point has a diamond tip. The base is 10¼ in. front to back and 7⅝ in. wide. Height of column, 13 in. Weight, 35 pounds.

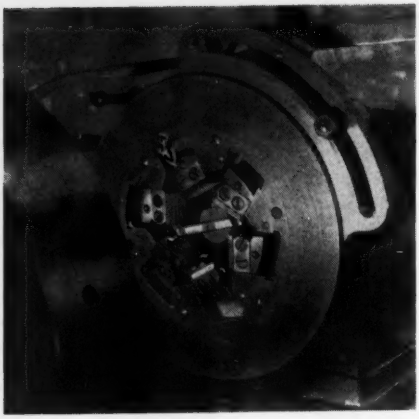


Federal Model 110B-3 Super Sensitive Comparator

Landis Special Reaming and Chamfering Fixture

The Landis Machine Co., Waynesboro, Pa., announces a reaming and chamfering fixture for use in Landis 4, 6 and 8-In. Stationary Pipe Die Heads. The fixture will perform the reaming and chamfering operation, during the threading operation, on all diameters of pipe within the capacity of a head.

The Landis Special Reaming Fixture is simple in design and can be applied to any Landis Pipe Threading and Cut-



Landis Special Reaming and Chamfering Fixture

ting Machine employing die heads of the above sizes. The fixture consists of a driver which is gripped in the pipe support at the rear of the crossrail, a centering ring which fits the bore of the crossrail supporting the driver in proper position, and within the driver a pressure spring which exerts a force agai a reaming tool holder which has a s ing fit within the bore of the dri This assembly is held together by draw screw which passes through driver to the opposite end where it adjustable to vary the spring pres

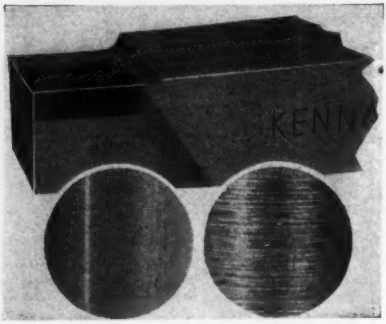
A separate reaming tool is requi for each diameter of pipe. The tool supported and locked in position in reaming tool holder by means of a head cap screw. In order to give pro support to the reaming tool, the reami tool holder covers only a partial ra of the head; thus, several tool hold may be required to cover the compl range of a head.

The use of this special fixture is a to improve the quality of the work that every thread cut is uniform chamfered and reamed. Likewise, t use of the tool will effect an increase production, since the reaming a chamfering operations are perform during the threading operation.

Kennametal Tipped Tools

Kennametal tipped tools, made McKenna Metals Company, 300 Li Ave., Latrobe, Pa., are now available three standard styles of blanks fr

which the tools may be tipped by the user or in an assortment of 18 styles of Kennametal tipped tools for operations such as reaming, boring, tapping, milling, gaging, and so on. The illustration shows the Style No. 11 tool, tipped with Kennametal, and the unretouched inserts show the smooth finish obtainable by the use of Kennametal working on



Style No. 11 Kennametal Tipped Tool and Surfaces (X3) Machined with Kennametal and with Another Tool

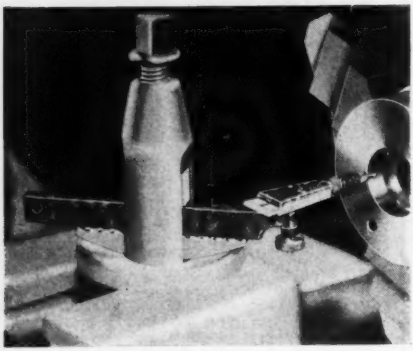
form-tooled bar stock (magnified times) as compared with the same face as machined with a different

Starrett "Universal Junior" No. 564 Indicator

An unusually sensitive and flexible indicator, to be known as the Starrett "Universal Junior" Indicator No. has been introduced by The L. S. Starrett Co., Athol, Mass., in answer to demand for an indicator that could used for the widest possible range applications. The unusual flexibility the tool is the result of a combination of special features.

The ball joint contact point is held a friction joint which permits it to moved to any angle. This friction joint is mounted at the end of a rotating friction sleeve which can be turned completely around. In addition, the indicator itself can be mounted on the top the side of the shank. The range adjustment makes it possible to move the indicator for any operation so that the graduated scale is always in most convenient position for easy reading without physical or eye strain

without the use of double scales or mirrors. In addition, this tool is furnished with a brass collar which serves as a



Starrett "Universal Junior" No. 564 Indicator

clamp for attaching the indicator to the jaw of a height gage.

The "Universal Junior" has a range of 0.012 in. by thousandths. Case-hardened steel and die cast parts are used throughout the tool.

Single Lever Spindle Speed Pre selector for B. & O. Nos. 5 an 7 Universal Turret Lathes

The Single Lever Spindle Speed Pre selector now available on Bardons Oliver Nos. 5 and 7 Universal Turre Lathes, products of Bardons & Olive Inc., Cleveland, Ohio, is said to mee a number of the demands of moder manufacturing. Handling time is re duced because the spindle speeds ma be preselected at any time and shifte almost instantaneously by the singl control lever. The spindle speeds ar indicated on a dial. In cases wher two or more speeds are needed on particular job, the operator will turn the preselector dial to the second spee while the machine is running at th first speed. When the operations at th first speed are completed, a simple movement of the single control leve opens the clutch, shifts the gears, an reconnects the drive to the spindle, set ting the machine for operating at th new speed.

The conventional clutch lever is used in operating the preselective gear shift As the lever is moved from the forward

or neutral brake position, it passes a point at which it may be slightly depressed. At this point the clutch has been disengaged and the gears are coasting momentarily. Depressing the lever is an effortless motion which opens the valve to a hydraulic system and allows the oil to flow into predetermined cylinders, causing certain sliding gears to move into positions corresponding to the spindle speed preselected by the dial, upon which the clutch is re-engaged. The entire operation takes but a few seconds. The hydraulic shifting of the gears eliminates practically all physical effort.

To assist in obtaining the correct spi dle speeds for any type of work, t spindle speed selector dial includes

Single Lever Spindle Speed Preselector f B. & O. Nos. 5 and 7 Universal Turret Lath

chart of cutting speeds based on th use of modern tools. A scale on th stationary cover is graduated to rea surface speeds in feet per minute. O the drum is a plate which gives th spindle speed and below that is a cha showing diameters, opposite the cu ting speeds. The cutting speed cha gives all the diameters correspondin to one spindle speed that fall within definite range of surface cutting speeds the diameters being expressed in inche and fractions. Removable clips on th dial carry numerals indicating the num ber and sequence of speeds desired fo the operations. By placing the spindl speeds above the cutting speed chart with figures of considerable size, they are read at a glance by the operator a he stands at operating position. Thi means one important thing—a quick visual check-up on whether the ma chine and tools are being used to full advantage.

Starrett Small Hole Gage No. 829

The Starrett Small Hole Gage No. 829 illustrated here has been designed by The L. S. Starrett Co., Athol, Mass., for measuring small holes and internal dimensions less than those ordinarily handled with telescoping gages. The gages are available in sets of four gages covering the ranges of ⅛ to 2/10 in., 2/10 to 3/10 in., 3/10 to 4/10 in., and 4/10 to ½ inch.

The end of each gage is in the form of a split ball which is expanded by cone controlled by the knurled knob the end of the handle. The ball placed in the hole, expanded to get "feel," and the measurement is transferred to a micrometer. The gages well balanced, highly sensitive in contact and adjustment, and are hardened against wear.

Starrett Small Hole Gage No. 829

Billings Cut-Off Tool

The Billings & Spencer Company, Hartford, Conn., announce the Billings Cut-Off Tool for cutting round stock including drill rod, wire, or the small diameters of bar stock. The tool is said to be especially useful in toolrooms, tool cribs, stock bins, stockrooms, ware houses, and so on.

The tool will cleanly cut off drill rod and wire from 0 to ¼ in. round inclusive without leaving a burr. The sawered ends of the stock are not distorted and are free for entry for additional cuts. The tool is fast in action, easy

to operate, and requires a minimum of exertion, since it is designed to utilize directly the leverage applied. It can be attached to a work bench permanently or can be set up in a vise in a few seconds.

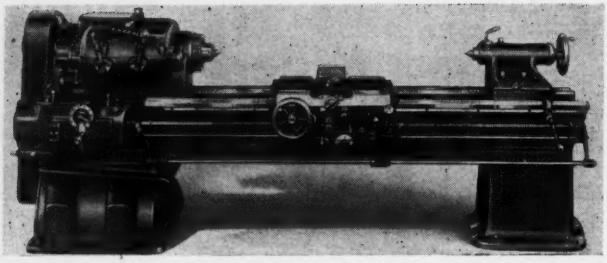
The tool is drop forged, carefully machined, properly heat treated, and is

Billings Cut-Off Tool

designed to give many years of service. The bar is 15¾ in. long, ⅞ in. in diameter, and is finished in a gray "Durn" finish with bright red end. The cut-off cam and block is in a natural rust-proof finish.

Boye & Emmes 20-In. Model C Geared Head Lathe

The Boye & Emmes Machine Tool Company, Cincinnati, Ohio, has brought out a 20-in. x 10-ft. Timken geared head lathe to be known as the Model C. The key drive spindle has a long taper and No. 2 nose. Twelve spindle speeds are available, the standard range being 15



Boye & Emmes 20-In. Model C Geared Head Lathe

silent chain dri
with drive pulle
mounted on an
friction bearings, su
ported at each side
the face in anti-fri
tion journals. T
driving clutch is
large diameter and
the multiple disc
plate type.

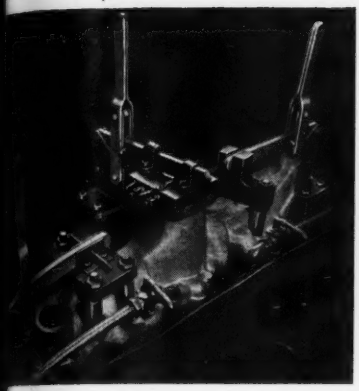
Forty-eight feed a
thread changes
available, and a qu
rant arrangem
makes it possible

to 436 r.p.m. The headstock gears are both splash and cascade lubricated, and the spindle journals are lubricated by pump with filtered oil through a sight glass gage. All gears are made from individual hammered forgings, normalized, heat treated, and the teeth lapped after hardening. Shafts are all heat treated alloy steel with six integral splines. The positive jaw tooth clutches are also heat treated.

The driving motor is mounted on a hinged plate in the head end cabinet leg, which is designed to provide adequate ventilation. Power is transmitted by multiple V-belt, flat belt, or

cut odd threads or coarse leads not p
vided for in the regular range of 1 to
threads. The carriage bearings on
bed consist of two 90 deg. inverted
and the flat at the front with full leng
scraped bearings. The carriage V's
32 in. long.

The apron journals, bed ways, c
riage cross slide, and cross feed scr
journal are automatically lubricated
a pump in the apron actuated by a p
ion meshed with the bed rack. Driv
clutch start and stop levers are locat
directly under the head in addition
one which is attached to and tra
with the apron. The distance betw



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The outstanding tool design development of two decades. Use straight shank drills (whole or broken) — Use entire drill or any part of it for given depths — use for single or multiple operations.

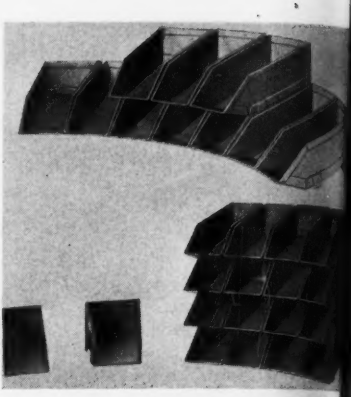
Send for detailed information without delay.

Scully-Jones & Company
STANDARD and SPECIAL PRODUCTION TOOLS
1913 S. ROCKWELL STREET, CHICAGO

centers on an 8-ft. bed length is 48 in. Domestic shipping weight for 10-ft. bed is 85 pounds.

Stackbin Assembly Bin

To fill a need for a uniform stackbin assembly bin which can be used on any assembly bench, Stackbin Corporation, 53 Troy St., Providence, R. I., has designed a new bin which keeps parts always within fingertip reach. Made with a sloping floor which feeds contents toward the front, the bins can be set up in a semi-circle, and can be stacked one above the other to



Stackbin Assembly Bin

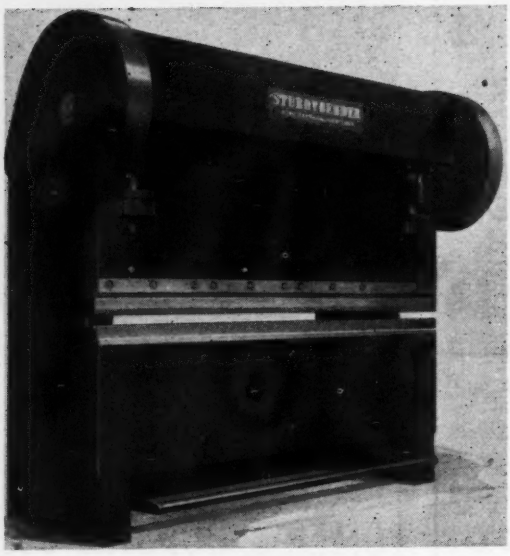
all parts within the most efficient
ing distance.

Eight inches long and 2½ inches
these new bins are four inches
in back and three inches wide in
Heavy gage sheet steel and
construction assure durability and
life.

"Sturdybender" Press

The Steelweld Machinery Sales
ion of Cyril Bath & Company,
chinery Ave., Cleveland, Ohio, annou
a new line of smaller bending
which will be called the Sturdy
line. These machines have been
oped to meet the demand for a
production type bending press
of delivering sharp, accurate
and precision in multiple
work. Sizes of the line of
be for handling up to 10-ft.
material.

The Sturdybender line



"Sturdybender" Bending Press

outstanding features of the Steelweld Bending Press, modified for lighter work. It has a one-piece all welded frame, heavy crown, and side housings which in the larger machines are 10 in. in width, the manufacturer having found that frame stability is a first essential for sharp bends on continuous production.

The Sturdybender also has the other distinguishing features found in the Steelweld line; namely, full tapering ram with slides that are self-adjusting and self-compensating for wear, solid forged eccentrics, twin gear and double gear drive, Twin Disc clutch and brake, all anti-friction ball or roller bea ings except mains, patente unbreakable ball joints, larg main and eccentric gearing bronze bushed. In addition, has a hollow bed, and becaus of frame stability is ideal fo multiple punching, notchin and other serial or separat operations where less sturd construction is likely to mea costly die upkeep. The bed an ram take standard brak punches and dies, and the en tire machine is designed wit a view of standing up t continuous production in th bending, forming, punchin and shaping of lighter mat rials.

Leiman Dust Collector for Surface Grinders

A dust collector for contin ous surface grinding opera tions which is said to be per cent efficient has bee placed on the market b Leiman Bros., Inc., 4W- Walker St., New York, N. The efficiency of the Leiman unit due to the dust collecting system em ployed in embracing a very powerf motor-driven suction fan which dra the dust from the surface grind through a suction hood and telescop jointed piping and transfers it direct to a metallic cyclone of ample propo tions.

The cyclone system whirls the du with high centrifugal force and con centrates the main body of the du mass into the cone, depositing it means of a powerful vortex into t dust receptacle at the bottom, the escaping through a bag which cov

the top of the cyclone.

The bag restrains very fine residue of dust, allowing only filtered air to escape. The dust hood can easily be attached to the present wheel guard by any mechanic. The suction pipe is provided with a telescoping feature to permit raising and lowering of the grinding wheel.

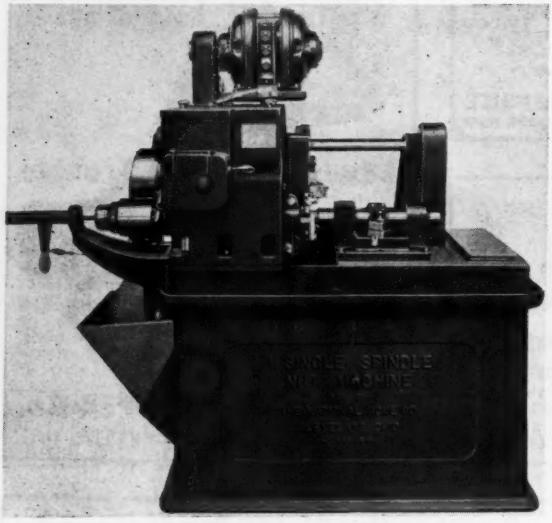
The Leiman Dust Collector for surface grinding occupies 18 x 33 inches of floor space. The standard units for alternating current operate at 110 volts

Leiman Dust Collector for Surface Grinders

National Acme 1½ Single Spindle Model SM Automatic

To combine maximum production with the advantage of a minimum of equipment for the manufacturer of small blanks, bearing parts, rollers, studs, inner races, and similar parts, the National Acme Company, 170 East 131st St., Cleveland, Ohio, has brought out the 1½-In. Single Spindle Model SM Automatic shown in the illustration. The Model SM is equipped with three slides of rugged design; two lower horizontal and one vertical above the work spindle. All three slides are operated by independent cams on the end of the

main drum shaft at the front end of the gear box. Stock is fed to the spindle from a slotted stock tube, a follower being controlled by a spring-operated drum in the base of the machine. Chucking is accomplished by a finger holder and draw-in type collet. The holder is operated by a cam on a drum on the end of the main drum shaft at the rear end of the gear box. Stock is fed against the drill when a stationary drill spindle is used or may be fed against an auxiliary stop when a rotating drill is used. The drill spindle feed is controlled by a cam and the drill spindle is returned after drilling by means of a spring.



National Acme 1½-In. Single Spindle Model SM Automatic

The front lower slide usually carries a cut-off tool, the rear lower slide usually carries the forming tool, and the vertical or upper slide serves as an auxiliary, all slides being cam-operated. All slides have independent adjustments. Feeds and speeds are controlled through pick-off change gears which are easily accessible. Drive is from a 3 h.p. motor to pulley shaft to spindle change gear shaft through spindle change gears to spindle drive shaft. The feed change gear shaft is driven by a gear on the spindle drive shaft and through feed change gears drives a small worm shaft which through a second worm shaft drives the main drum shaft. A high and low speed clutch mechanism for slow speeds and feeds is available.

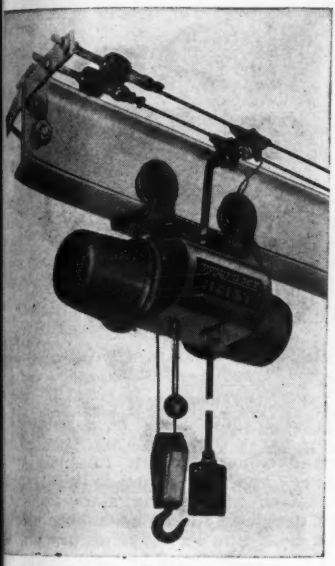
The length of the stock reel is 20 ft. and the capacity of the collet is 1½ in. round, or 1⅞ in. hexagon. Standard length of feed, 2¾ in. Pulley speed, 770 r.p.m. Floor space required, exclusive of stock reel, 54 x 2[illegible] in. Net weight with motor, 3,050 lbs. Equipment includes the necessary change gears, cams, collet, forming and cut-off tool holders, and stock stop.

Wright Speedway Electric Hoi[illegible]

The Speedway, a light weight low cost wire rope electric hoist, has been added to the line of material handling equipment made by the Wright Manu[illegible]

...turing Division of the American ...ain & Cable Company, Inc., York, ... Hoisting capacities range from ... to 750 lbs. and hoisting speeds from ... to 43 ft. per minute.

The Wright Speedway Electric Hoist ...ndard construction includes fully en-



Wright Speedway Electric Hoist

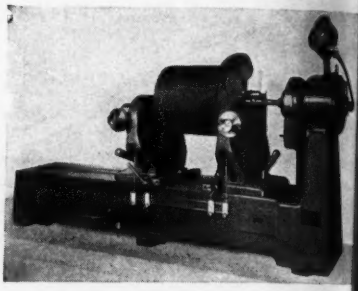
...ed ball bearing motor, anti-friction ...rings, cut alloy steel spur gears, ...ltiple disc solenoid brake, push but- ... control, preformed hoisting cable, ... many other features which make it ...able for production service.

...he hoist is made in three types for ... suspension, hook suspension, or for ...nting on a trolley.

Globe Neon Equipoise Dynamic Balancing Machine

To the line of Neon Dynamic Balancers built by The Globe Tool & Engineering Co., 420 Davis Ave., Dayton, Ohio, has been added a balancing machine of new type, to be known as the Neon Equipoise Dynamic Balancer. The feature of the new machine is that any unbalance in any plane selected by the operator can be completely neutralized and an accurate reading can be given as to angle and amount of unbalance in the other plane.

In the development of balancing machines, it has been the objective of engineers to develop a machine in which the unbalance in one plane could be completely neutralized while the amount of unbalance in the other plane was being noted. To produce this result



Globe Neon Equipoise Dynamic Balancing Machine

heavy cradles have been used and in some cases the entire machine bed comprised a cradle with fulcrums applied under one correction plane. Another objective of the engineers working on the development of balancing machines has been the extreme accuracy of balance, which involves the weight ratio of the mounting of the part to be balanced to the actual part to be balanced. The lighter the saddle mounting can be made in comparison to the weight of the workpiece, the more accurate will be the ultimate results.

The design of the Neon Equipoise Dynamic Balancer is said to retain all of the good points of the previous "N" Series machines in addition to the equipoise bar which has been added to ob

tain maximum results in reading the exact amount of unbalance at the exact angle in any plane which the operator may want to select, completely neutralizing all unbalance in the other plane regardless of its angle or amount. The machine having the equipoise feature will be available in sizes to handle weights from a few ounces to 14,000 pounds.

The new equipoise feature can be added to any of the older "N" Series dynamic balancing machines made by this company and can also be added to other dynamic balancers.

Murchey Type M Collapsible Machine Tap

A collapsible machine tap of new design for tapping straight threads is now being marketed by Murchey Machine & Tool Company, Detroit, Mich. The tap is universal in type, ready for conversion into either a rotating or stationary tap, and can be used with the handle as a non-rotating tap on turret lathes or hand screw machines or, by removing the handle, as a rotating tap on drill presses and tapping machines.

The Type M Machine Tap mechanism is fully enclosed to protect it from chips and dirt. It is of unusually sturdy con-

Murchey Type M Collapsible Machine Tap

struction, the body being heavy and of special alloy steel with a tap nose amply large for complete chaser support. The collapsing mechanism is instantaneous in action and the chasers are instantly and positively collapsed, ensuring threads of accurate length under all conditions. Chasers are expanded or contracted by turning an adjusting screw located at the rear end of the center pin. When set, the adjusting pin may be locked to ensure that the chasers will permanently retain accurate size. This adjustment can quickly and positively be made without removing the tap from its spindle.

Chasers used in the Type M Tap are of special grade high speed steel and the bearings of the chasers are precision ground to ensure accuracy. The tap is made in 11 sizes from 1¼ to 4½ in. with shanks from 1½ to 3-in. diameter.

Automatic 2-point gaging to fractional ten-thousandths

Through unique self-aligning and centering features, Comtorplug "makes every man an expert gager." Direct reading enables inspectors and operators on precision bores to detect size, out-of-round, front or back taper, barrel shape, etc., to a fraction of .0001".

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RIDGID PIPE TOOLS

Armstrong-Bray Universal Belt Cutter

Efficiency is combined with economy in the Universal Belt Cutter now being marketed by Armstrong-Bray & Co., 304 N. Loomis St., Chicago, Ill. The cutter handles leather, fabric, and rubber belts up to 8 in. in width, and is designed to hold the belt securely against a side guide while the knife is drawn down through a track that assures an accurate, square cut. The track also prevents the knife from slipping, thus injuring the operator. Light in weight and compact, this cutter can either be bolted to a bench or carried to the job. There are no parts to wear out, and the knife blade can easily be resharpened or, if necessary, replaced at a cost of a few cents.

Armstrong-Bray Universal Belt Cutter

Motor-Mica

Motor-Mica, a powdered lubricant manufactured by Scientific Lubricants Company, 3462 N. Clark St., Chicago, Ill., is now being distributed through the Motor-Mica Sales Company, 549 W. Washington St., Chicago, Ill. Motor-Mica is a powdered lubricant used in deep drawing, for cooling bearings, plastic and rubber molding, die casting, drilling, wire drawing, and so on.

Wilbur & Williams "Metal Dip"

A coating for new metal tools, to be known as "Metal Dip," which is said to prevent tarnishing during storage and transportation has been placed on the market by The Wilbur & Williams Company, Park Square Bldg., Boston, Mass. Metal Dip can be applied to tools made of copper, steel, brass, or any other base metal.

Metal Dip dries in approximately 30 seconds to a very thin film which completely coats the metal surface and prevents tarnishing. The coating material is colorless and practically invisible when used in a dipping bath.

Metal Dip is said to have excellent adhesion on smooth metal surfaces. It can be applied to any clean metal surface, free of dirt, grease, or oil, by dipping or spraying.

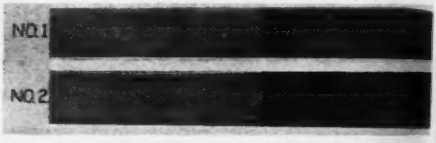


Illustration showing two bright copper strips. The left half of each strip was dipped in Metal Dip and allowed to dry for one minute in air and then exposed to chemical fumes for 24 hours. No. 1 was exposed to chlorine gas and No. 2 was exposed to hydrogen sulphide gas.

Grobet Cylindrical Plug Gages

The Grobet File Corp. of America, 3 Park Pl., New York, N. Y., announces its new line of cylindrical plug gages for use in checking small flat drill holes. The plugs are made of high carbon tool steel and are hardened, ground and precision lapped. According to the manufacturer, the Grobet Cylindrical Plug Gages are guaranteed in accuracy to plus or minus 0.000025 in. (0.0006 mm.). A full-size plug gage is shown in the illustration herewith.

In use, the cylindrical plug gages are held in hollow hardened steel holders by collets from which they can be easily removed, reversed, or replaced. All handles of the steel holders are marked with the diameter of the gage.

Gages in diameters from 0.010 in. to

Grobet Cylindrical Plug Gage

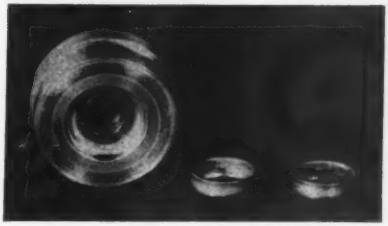
0.004 in. in sizes graduated by 0.001 in. are maintained in stock. However, gages in sizes varying by 0.0005 in., 0.00025 in., or 0.0001 in., from 0.004 in. to 0.150 in., or in the metric system in every 1/4/100 mm. from 0,25 mm. to 4.00 mm., can be supplied by special order. Double end gages for checking tolerances can also be supplied upon special order.

Kennametal Die Inserts

A hard carbide insert for dies used in stamping and drawing automobile parts, chair casters, bottle caps, cans, electrical appliances, wire and other metal products for home and industrial use, has been announced by McKenna Metals Co., 300 Lloyd Ave., Latrobe, Pa. Recent tests conducted by a large caster manufacturer are said to indicate that dies faced with the new material, known as Kennametal, will outlast ordinary tool steel dies many times.

In regular production runs Kennametal-faced dies stamped out 70,000 chair casters before the first regrind, as compared with a total life of 14,000 pieces for the tool steel die they had been using. While this represents an increase of 500 per cent in the number of pieces turned out, Kennametal-faced dies actually have an even greater advantage, for they may be reground several times before being discarded. The die in the illustration has stamped out 11,000 casters without any visible sign of wear.

The basic ingredient of Kennametal



Die with Kennametal Insert from which 11,000 chair casters of the type shown on the right have been stamped.

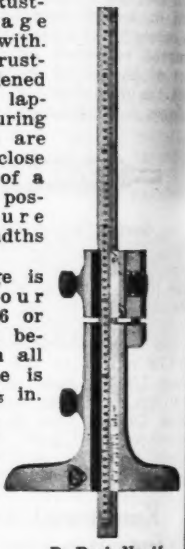
alloys is an intermetallic compound of tungsten-titanium carbide, corresponding to the formula WTiC2. Kennametal is claimed to be an ideal material for machine tool tips, because of its ability to machine steel heat-treated up to 500 Brinell while combining roughing and finishing in one operation, as well

as its adaptability to the machining of softer metals. Eighteen standard styles of Kennametal-tipped tools are available, as well as three standard styles of blanks for those who braze their own tools. However, special blanks can be supplied upon request.

P. Roch No. 15 Rustless Depth Gage

Park Sales Company, 3 Park Place, New York, N. Y., is now marketing the P. Roch No. 15 Rustless Depth Gage illustrated herewith. The blade is of rustless steel, hardened and accurately lapped at the measuring ends. The jaws are ground to very close limits. The use of a vernier makes it possible to measure depths to thousandths of an inch.

The depth gage is available in four lengths; 8, 12, 16 or 20 in., the base being 3 in. long in all cases. The blade is $\frac{1}{16}$ in. thick by $\frac{1}{2}$ in. wide. The entire instrument is finished to meet the highest requirements for tool and instrument making.



P. Roch No. 15 Rustless Depth Gage

Electronic Portable Blue Line Printer

The illustration shows a portable blue printing machine now being offered by Electronic Products Mfg. Corp., 208 W. Washington St., Ann Arbor, Michigan. The machine prints blue lines on a white background and is said to be simple and economical to operate.

The Blue Line Printer is housed in a substantially built cabinet that is finished in an attractive gun metal wrinkle finish. It operates on an ordinary power circuit of 110 volts A.C. or D.C. The light source consists of six special lamps designed for maximum illumination, the

total wattage being 850. The lamps are rated for 100 hours, which permits the printing of approximately 5,000 prints.

Electronic Portable Blue Line Printer

The light is turned on and off by a "precision" micro-action switch in the door frame, assuring the use of lights only when printing. A highly polished aluminum reflector assures uniform light distribution. The printer is furnished complete with lamps, developing cylinder, and 12 sheets of Ozalid paper.

Billings & Spencer Marketing Bemis & Call Wrenches

The Billings & Spencer Company, Hartford, Conn., has acquired the Wrench Division of the Bemis & Call Company and all of the wrench products—including the famous Coes line—formerly produced by Bemis & Call Company will be produced and marketed from the Billings & Spencer Hartford plant.

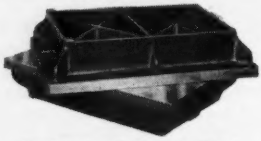
Our Error

In the announcement of the Reid Improved No. 2 Automatic Surface Grinder which was published on page 200 of the March, 1939, issue of this magazine, the spindle speed was given as 2,500 r.p.m. This should be 3,500 r.p.m.

Surface and Bench Plates

Seasoned surface and bench plates which are guaranteed by the manufac-

turer against defects in material and workmanship have been introduced by The Master Tapper Co., 4 Main St., Belleville, N. J. The plates are available in sizes of 11 x 15, 12 x 18, 18 x 24, 24 x 24, and 24 x 36 in., and in weights



Surface and Bench Plate

of 45 to 350 lbs. The 11 x 15-in. size is available either with a ground surface and sides unfinished, or hand scraped. All sizes are available rough as they come from the planer or hand scraped.

New Literature

Troyke Rotary Tables for milling machines, slotters, die sinkers, shapers, and drilling machines, in sizes of 9, 12, 15 and 18 in., are illustrated and described in a four-page bulletin issued by Alfred A. Troyke, 219 E. Second St., Cincinnati, Ohio. Two new combination tables which may be used for plain milling and for dividing are also shown. Copy free upon request.

Skilsaw Portable Electric Tools. This 54-page book comprises a comprehensive presentation of the line of portable electric tools for production, maintenance and construction work made by Skilsaw, Inc., 3310 Elston Ave., Chicago, Ill. Equipment illustrated and described in Catalog No. 40 includes hand saws, drills, belt sanders, disc sanders, grinders, blowers, and a floor sander. The catalog is conveniently divided into sections, a section being devoted to each of the above tools, together with the accessories available for each item.

Landis No. 2 Race-A-Way Grinder. This 16-page bulletin, designated as No. RW-3 and published by the Landis Tool Company, Waynesboro, Pa., presents by means of description and photographs, the features and advantages of the Landis No. 2 Race-A-Way Grinder. Discussed in turn are the operation of the grinder, the Landis-Solex Sizing Device, general features of design, electrical equipment and general equipment. Specifications are listed. Copy free upon request.

Colwell Tool Post Turret. Instructions for mounting and operating the Colwell Tool Post Turret, product of S. G. Colwell, 25 Congress Ave., Providence, R. I., are contained in a four-page folder. The turrets can be supplied in sizes for lathes from 9 to 18 in. Copy free.

"Hacksaw-Ology" is the title of a booklet of helpful hints on the care and use of hack saw blades, in which the various types of blades are nicely illustrated and described. Several pages are filled with suggestions for the proper operation of hack saws for either hand or power machine use. This 6 x 9-in. educational booklet will be mailed free upon request to the publisher—Simonds Saw and Steel Co., Fitchburg, Mass.

Janette "Precision Built" Electrical Apparatus. The line of electrical equipment manufactured by Janette Manufacturing Company, 556 W. Monroe St., Chicago, Ill., is conveniently presented in a folder now being issued by this firm. Products shown include various types of motorized speed reducers, inverted rotary converters, A.C. and D.C. generators, blower wheels, and custom built gasoline electric plants. Copy free upon request.

Precision Measuring Tools. Catalog No. 30 now being distributed by The Van Keuren Co., 12 Copeland St., Watertown, Mass, is a 28-page booklet featuring the following items: New Light Wave Measuring Equipment, Improved Light Wave Micrometer, High Speed Steel Measuring Wires, Simplified Gear Wire System, Gage Blocks, and Plug Gages. It contains valuable reference tables for using gear wires, Whitworth and Metric measuring wires, a table of Coefficients of Expansion, and a reprint of the complete specifications on measuring wires as set forth in the report of the National Screw Thread Commission. Copy free upon request.

FOR YOUR CATALOG LIBRARY

To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. **Machine Shop Equipment**
New 72-page catalog No. 39, issued by Atlas Press Co., 346 N. Pitcher St., Kalamazoo, Mich., illustrates and describes the Atlas line of lathes, shapers, drill presses, vises, arbor presses, etc.

2. **Crater Compound Booklet**
The Texas Company, 135 E. 42nd St., New York, N. Y., has issued a new 32-page booklet of practical information relating to open gear teeth and wire rope protection.

3. **IMP Lo-Swing Lathe**
Bulletin N-29 details the improvements and refinements incorporated in the latest IMP Lo-Swing Lathe. Seneca Falls Machine Co., Seneca Falls, New York.

4. **Sensitive Precision 10-In. Lathe**
A new catalog featuring the new Monarch 10-In. Sensitive Precision Lathe has been published by The Monarch Machine Tool Co., Sidney, Ohio.

5. **Automatic Bar Machine**
The New RA-8 Catalog, released by National Acme Co., Cleveland, Ohio, illustrates the new design features of the Acme-Gridley 8-Spindle Automatic Bar Machine.

6. **Tool Storage**
Lyon Metal Products, Incorporated, 1303 River St., Aurora, Ill., has issued a new, complete catalog showing Lyon Steel Tool Storage Equipment for toolroom needs.

7. **Drill Chucks**
Folder 100, released by Scully-Jones & Co., 1913 S. Rockwell St., Chicago, Ill., illustrates, describes and lists prices on "Feed as you need" Chucks.

8. **Torch Machine**
The Hayes Torch Machine, for cutting rolled sections in preparation for welding, is illustrated and described in a new catalog just released by Hayes Track Appliance Co., Richmond, Ind.

9. **Grinding Wheel Data Book**
A new 112-page Grinding Wheel Data Book has been published by Abrasive Company, Tacony and Fraley Sts., Philadelphia, Pa.

10. **Thread Tips**
Landis Machine Co., Inc., Waynesboro, Pa., is issuing a bi-monthly bulletin titled "Thread Tips."

11. **Cemented Carbide Tools**
"Hidden Profits in Your Machine Shop" is the title of an interesting booklet available from Carboloy Company, Inc., 11143 E. 8 Mile Rd., Detroit, Michigan.

12. **Tapping Hints**
"Nevers for Tapping" is the title of an attractive, cleverly presented booklet giving valuable information for tap users. John Bath & Co., Worcester, Massachusetts.

13. **Needle Point Diamonds**
F. F. Gilmore & Co., 112 Dartmouth St., Boston, Mass., has issued a new folder detailing Gilmore Needle Point Diamonds for truing fine grained or sharp edge grinding wheels.

14. **Turret Lathe Tools**
Jones & Lamson Machine Co., Springfield, Vt., has issued an attractive 24-page catalog featuring tools for J & L Flat Turret Lathes.

15. **Tungsten Carbide Tips, Tools and Dies**
A new 28-page catalog has been issued by Willey's Carbide Tool Co., Detroit, Mich. It illustrates and describes representative shapes and sizes of Willey's Tungsten Carbide Tips, Tools and Dies.

16. **Airplane Tools**
Available from Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y., is an attractive 18-page catalog illustrating and describing applications of Chicago Pneumatic Tools especially used in the manufacture of airplanes.

17. **Metal Cutting Tools**
Midwest Tool and Mfg. Co., 2360 W. Jefferson Ave., Detroit, Mich., has available for tool buyers a new Metal Cutting Tool Catalog No. 16.

18. **Tool Bits**
A new folder describes in detail seven different types of Rex Tool Bits which are made of high speed steel. Crucible Steel Co. of America, 405 Lexington Ave., New York, N. Y.

19. **High Cycle Electric Tool Facts**
Rotor Air Tool Company, 17325 Euclid Ave., Cleveland, Ohio, has issued a new 32-page catalog featuring drills, screw drivers, nut setters, grinders, buffers, sanders, polishers, etc.

20. **Data Book on Couplings**
Ajax Flexible Coupling Co., Westfield, N. Y., has available a new data book on couplings.

21. **Demagnetizers**
Walker A.C. and D.C. Demagnetizers are detailed in circular K7. O. S. Walker Co., Inc., Worcester, Massachusetts.

22. **Bearing Handbook**
New Departure, Division General Motors Corporation, Bristol, Conn., has available for bearing buyers the latest Handbook including load ratings, dimensions, bearing fits and list prices.

23. **Motor and Generator Construction Drawings**
Construction drawings of motors, generators, gear units, alternators and brake motors are included in a new bulletin issued by Star Electric Motor Co., Bloomfield, N. J.

24. **Bronze Bearings, Seals, etc.**
"The Jewel of Metals" is the title of a booklet issued by the Frederickson Company, Saginaw, Mich., which features Sabeco Bronze bearing metal.

25. **Multi-Miller**
The New U. S. Multi-Miller for high-speed production on small parts is illustrated and described in new Bulletin MM-2. U. S. Tool Company, Inc., Ampere, East Orange, New Jersey.

Print plainly in filling out coupon for literature.

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FORGINGS .:. EMPLOYMENT .:. BUSINESS .:. ETC.

"Ketos" Oil Hardening Tool Steel. This six-page folder, issued by Crucible Steel Company of America, 405 Lexington Ave., New York, N. Y., describes "Ketos" Oil Hardening Non-Deforming Tool Steel—a product recommended by the manufacturer for use where toughness, non-warping and safety in hardening are first considerations. Ketos finds its widest application for blanking, trimming, and forming dies of intricate design. Its freedom from movement, combined with its ability to resist wear, are said to make it particularly suitable for gages, taps, master tools, and so on.

The booklet includes general instructions covering forging, annealing, hardening, tempering and hardness. Copy free. Ask for folder No. TS201.

"There's One in Every Shop" — *By Wesser*

Contour Sawing. A 150-page Handbook on Contour Sawing, issued by Continental Machine Specialties, Inc., 1306 S. Washington Ave., Minneapolis, Minn., is now available. Because of the wide demand for the earlier edition, Continental has enlarged and revised the publication, including material from case record book, "25 Ways to Cut chining Costs," as well as complete gineering data on Doall contour saw technic. Copy free.